OD-624

TOUCHSCREEN DIGITAL STORAGE OSCILLOSCOPE

Version	Date	Firmware Version
1.0	October 2014	2.0.5

- 0 MI2011 -

SAFETY RULES ⚠

* **The safety can turn compromised if there are not applied the instructions given in this Manual.**

* Use the equipment only on systems or devices to measure the negative connected to ground potential or off-grid.

* This is a **class I** equipment, for safety reasons plug it to a supply line with the corresponding **ground terminal**.

* This equipment can be used in **Over-Voltage Category II** installations and **Pollution Degree 1** environments (see 2.3.-).

* When using some of the following accessories **use only the specified ones** to ensure safety:

  Power cord

  Probes

* Observe all **specified ratings** both of supply and measurement.

* Remember that voltages higher than **70V DC** or **33V AC rms** are dangerous.

* Use this instrument under the **specified environmental conditions.**

* **The user is only authorized to** carry out the following maintenance operations:

  Replace the mains fuse of the **specified type** and **value**.

  On the Maintenance paragraph the proper instructions are given.

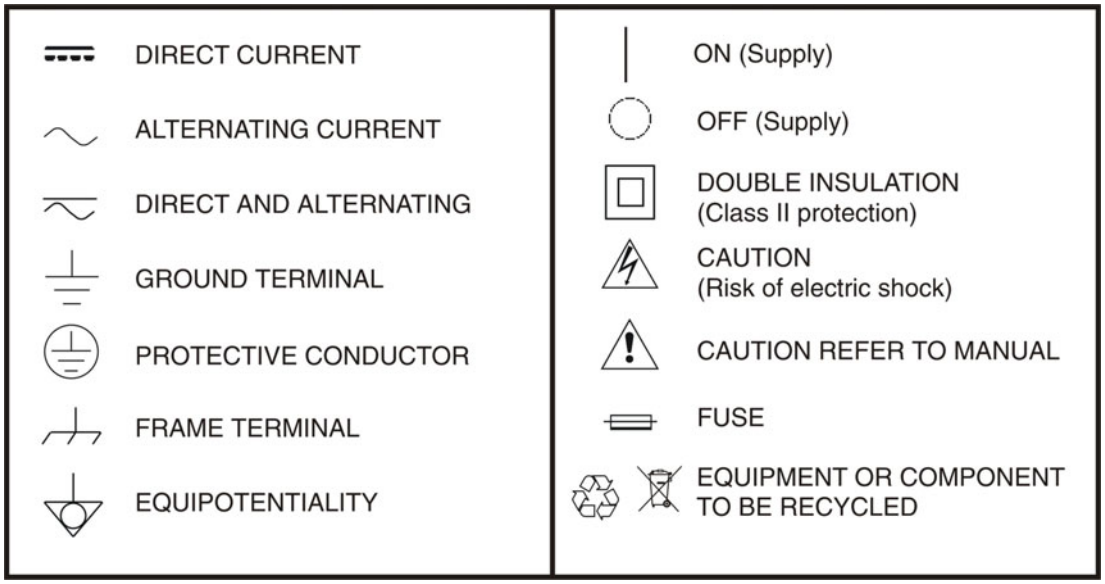
  Any other cha**nge on the equipment should be carried out by qualified personnel.**

* **The negative of measure** is at ground potential.

* **Do not obstruct the ventilation system.**

* Follow the **cleaning instructions** described in the Maintenance paragraph.

* Symbols related with safety:



Specific Precautions

Radio interference

ATTENTION **This is a product of class A. In a domestic environment can produce radio interference, in which case the user should take appropriate measures.**

Descriptive Examples of Over-Voltage Categories

Cat I Low voltage installations isolated from the mains.

Cat II Portable domestic installations.

Cat III Fixed domestic installations.

Cat IV Industrial installations.

TABLE OF CONTENTS

1 INTRODUCTION 1
1.1 General Characteristics 1
2 JUNIOR USER GUIDEBOOK 2
2.1 Introduction to the Structure of the Oscilloscope 2
2.1.1 Front Panel 2
2.1.2 Rear Panel 4
2.1.3 Control (key and knob) Area 5
2.2 User Interface Introduction 6
2.3 How to Implement the General Inspection 8
2.4 How to Implement the Function Inspection 9
2.5 How to Implement the Probe Compensation 10
2.6 How to Set the Probe Attenuation Coefficient 11
2.7 How to Use the Probe Safely 12
2.8 How to Implement Self-calibration 12
2.9 Introduction to the Vertical System 13
2.10 Introduction to the Horizontal System 14
2.11 Introduction to the Trigger System 15
2.12 Introduction to the Touchscreen Controls 16
2.12.1 Set the Vertical System through touchscreen 16
2.12.2 Set the Horizontal System through touchscreen 17
2.12.3 Zoom the Waveform through Touchscreen 17
2.12.4 Operate the Menu through Touchscreen or Buttons/Knob 19
2.12.5 Other operations using touchscreen 20
3 ADVANCED USER GUIDEBOOK 21
3.1 How to Set the Vertical System 21
3.1.1 Use Mathematical Manipulation Function 24
3.1.2 Using FFT function 26
3.2 Use VERTICAL POSITION and VOLTS/DIV Knobs 29
3.3 How to Set the Horizontal System 30
3.3.1 Zoom the Waveform 30
3.4 How to Set the Trigger System 31
3.4.1 Edge Trigger 33
3.4.2 Video Trigger 34
3.4.3 Pulse Width Trigger 35
3.4.4 Slope Trigger 36
3.5 How to Operate the Function Menu 37
3.5.1 How to Implement Sampling Setup 37
3.5.2 How to Set the Display System 39
3.5.3 How to Save and Recall 42
3.5.3.1 To save the current screen image 42
3.5.3.2 To save waveform data to reference waveform/storage 43
3.5.3.3 To save setup files 44
3.5.3.4 To display/remove reference waveforms 44

3.5.3.5 To recall waveform data in storage....45
3.5.3.6 To recall setup files....45
3.5.3.7 To select the path or file in file explorer....45
3.5.3.8 To edit file names....46
3.5.3.9 To save with Copy button push....47
3.5.3.10 To manage file....47
3.5.4 How to Implement the Auxiliary System Function Setting....48
3.5.5 How to Measure Automatically....53
3.5.5.1 The automatic measurement of voltage parameters....55
3.5.5.2 The automatic measurement of time parameters....56
3.5.6 How to Measure with Cursors....57
3.5.6.1 The Cursor Measurement for normal mode....57
3.5.6.2 The Cursor Measurement for FFT mode:....60
3.5.7 How to Use Autoscale....61
3.5.8 How to Use Executive Buttons....63
4 COMMUNICATION WITH PC....65
4.1 Using USB Port....65
4.2 Using LAN Port....66
4.3 Connect through a router....68
5 DEMONSTRATION....70
5.1 Example 1: Measurement a Simple Signal....70
5.2 Example 2: Gain of an Amplifier in a Metering Circuit....71
5.3 Example 3: Capturing a Single Signal....73
5.4 Example 4: Analyze the Details of a Signal....75
5.5 Example 5: Application of X-Y Function....76
5.6 Example 6: Video Signal Trigger....78
6 TROUBLESHOOTING....79
7 SPECIFICATIONS....81
8 MAINTENANCE....85
8.1 General Care....85
8.2 Cleaning....85

TOUCHSCREEN DIGITAL OSCILLOSCOPE
OD-624

1 INTRODUCTION

1.1 General Characteristics

- Bandwidth: 200 MHz, 4 CH.
- Sample rate: 2 GS/s.
- 7.6 M record length.
- Waveform zooming (horizontal/vertical) and saving.
- FFT points (length and resolution variable.
- Multi-windows extension.
- User-friendly voice warning.
- 8 inch (800X600 pixels) high definition touchscreen.
- Multi-communication interface: USB, VGA, LAN.

2 JUNIOR USER GUIDEBOOK

This chapter deals with the following topics mainly:

- Introduction to the structure of the oscilloscope.
- Introduction to the user interface.
- How to implement the general inspection.
- How to implement the function inspection.
- How to make a probe compensation.
- How to set the probe attenuation coefficient.
- How to use the probe safely.
- How to implement an auto-calibration.
- Introduction to the vertical system.
- Introduction to the horizontal system.
- Introduction to the trigger system.
- Introduction to the Touchscreen Controls.

2.1 Introduction to the Structure of the Oscilloscope

When you get a new-type oscilloscope, you should get acquainted with its front panel at first and the digital storage oscilloscope is no exception. This chapter makes a simple description of the operation and function of the front panel of the oscilloscope, enabling you to be familiar with the use of the oscilloscope in the shortest time.

2.1.1 Front Panel

The oscilloscope offers a simple front panel with distinct functions to users for their completing some basic operations, in which the knobs and function pushbuttons are included. The knobs have the functions similar to other oscilloscopes. The 5 buttons (F1 - F5) in the column on the right side of the display screen or in the row under the display screen (H1 - H5) are menu selection buttons, through which, you can set the different options for the current menu. The other pushbuttons are function buttons, through which, you can enter different function menus or obtain a specific function application directly.

Figure 1. Front Panel.

1. Display area.
2. Control (key and knob) area.
3. Probe Compensation: Measurement signal (5V/1KHz) output.
4. Signal Input of 4 Channels.
5. Menu off.
6. Power on/off.
7. Folding Foot in the bottom (which tilt the oscilloscope).

2.1.2 Rear Panel

Figure 2. Rear Panel.

1. **USB Host port**: It is used to transfer data when external USB equipment connects to the oscilloscope regarded as "host device". For example: upgrading software by USB flash disk needs to use this port.
2. **USB Device port**: It is used to transfer data when external USB equipment connects to the oscilloscope regarded as "slave device". For example: to use this port when connect PC to the oscilloscope by USB.
3. **VGA port**: To connect the oscilloscope with external equipment as serial port, or to connect the oscilloscope with a monitor or a projector as VGA output.
4. **LAN port**: the network port which can be used to connect with PC.
5. The port of trigger signal output & Pass/Fail output.
6. AC power input jack.
7. Handle.

2.1.3 Control (key and knob) Area

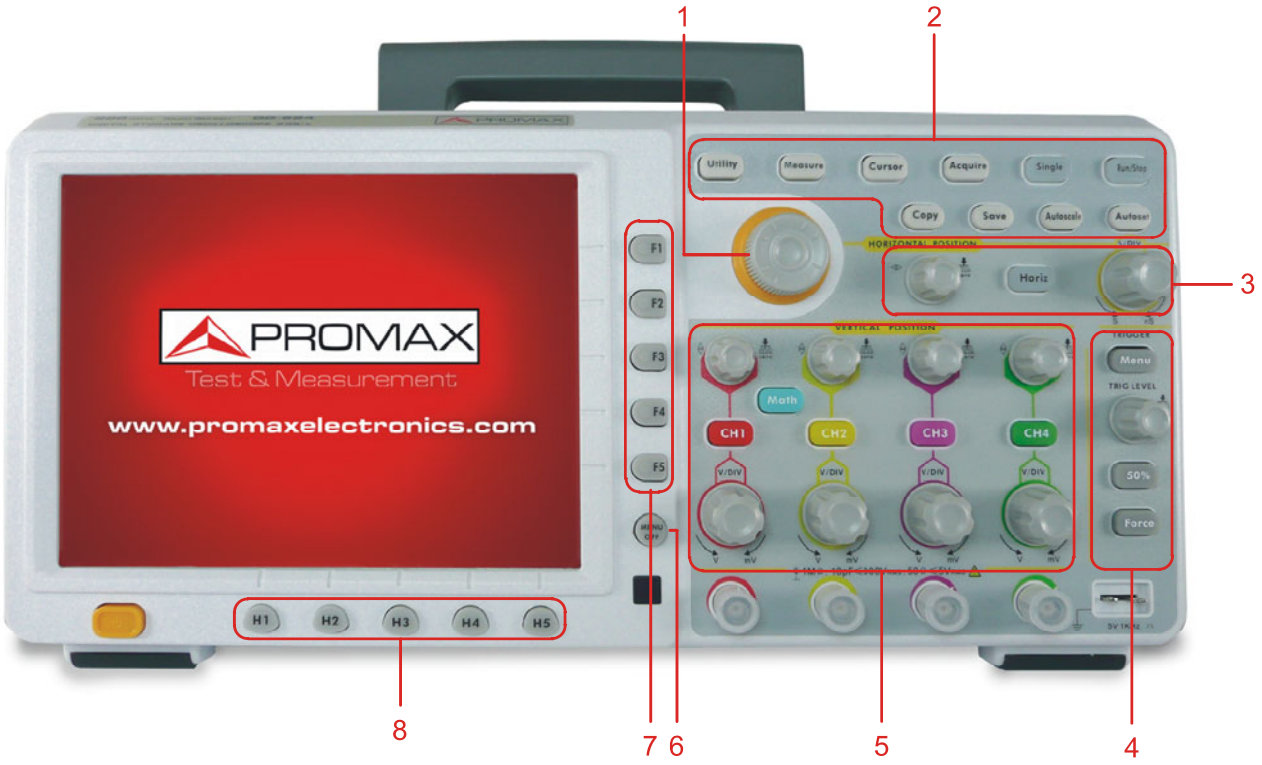


Figure 3. Keys Overview

1. **G** knob (General knob): when a G symbol appears in the menu, it indicates you can turn the **G** knob to select the menu or set the value.
2. Function key area: Total 10 keys.
3. Horizontal control area with 1 key and knobs.

   "HORIZONTAL POSITION" knob control trigger position, "SEC/DIV" control time base, "Horiz" key can enabled/disabled the split-screen zoom.
4. Trigger control area with 3 keys and 1 knob.

   "TRIG LEVEL" knob is to adjust trigger voltage. Other 3 keys refer to trigger system setting.
5. Vertical control area with 5 keys and 8 knobs.

   CH1~CH4 keys correspond to setting menu in CH1~CH4, "Math" key provides access to math waveform functions (+, -, ×, /, FFT). Four "VERTICAL POSITION" knob control the vertical position of CH1~CH4, and four "VOLTS/DIV" knob control voltage scale of CH1~CH4.
6. Menu off: turn off the menu.

7 Menu option setting: F1~F5.

8 Menu option setting: H1~H5.

2.2 User Interface Introduction

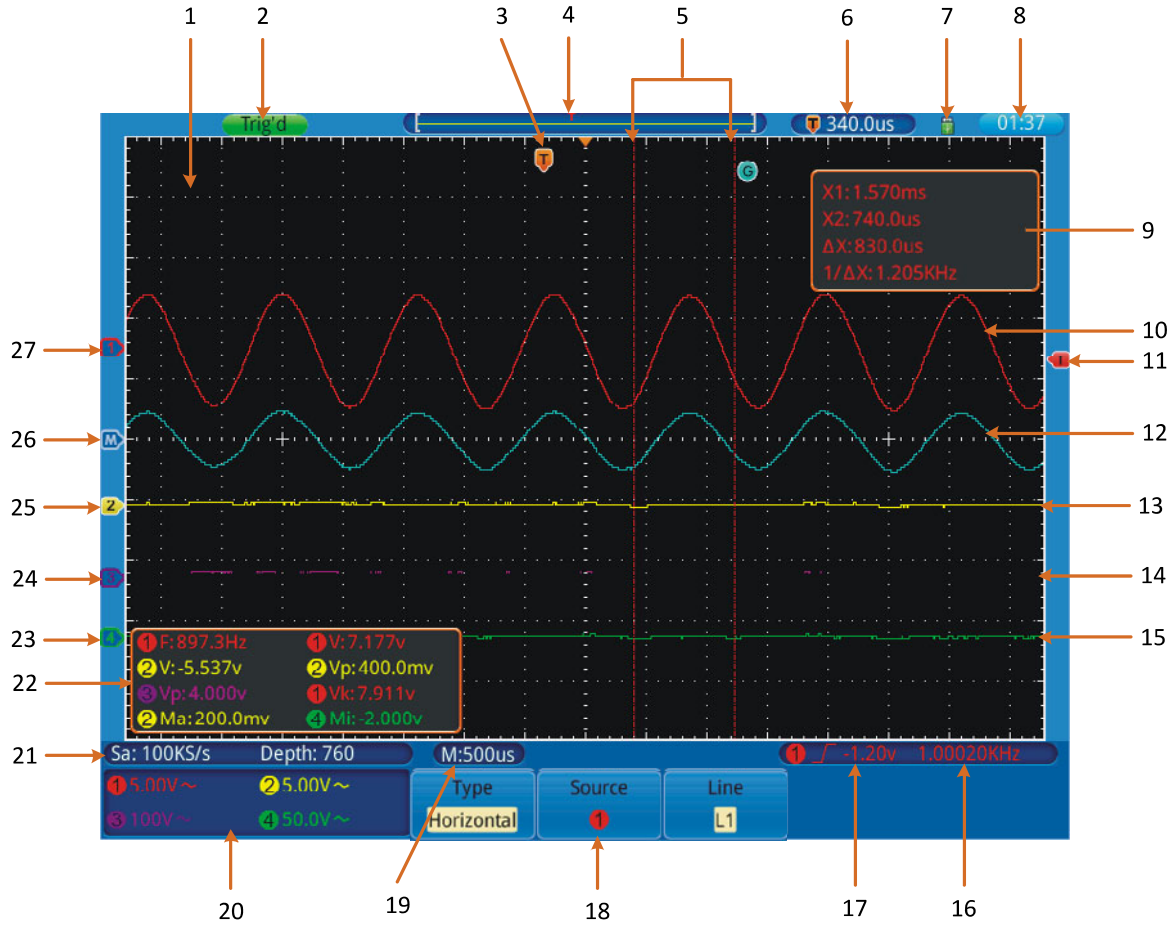


Figure 4. Illustrative Drawing of Display Interfaces.

1 Waveform Display Area.

2 The state of trigger, including:

Auto: Automatic mode and acquire waveform without triggering.

Trig'd: Trigger detected and acquire waveform.

Ready: Pre-triggered data captured and ready for a trigger.

Scan: Capture and display the waveform continuously.

Stop: Data acquisition stopped.

3. T pointer indicates the horizontal position for the trigger.
4. The pointer indicates the trigger position in the internal memory.
5. Cursor for cursor measurement.
6. Present triggering value.
7. It indicates that there is a U disk connecting with the oscilloscope.
8. Setting time (touchable).
9. Cursor measure window, showing the readings of the two cursor and absolute value.
10. The waveform of CH1.
11. The pointer shows the trigger level position of the source in trigger menu.
12. The waveform of Math.
13. The waveform of CH2.
14. The waveform of CH3.
15. The waveform of CH4.
16. The cymometer of the source in trigger menu.
17. Trigger settings of the source in trigger menu.

    The icon shows the trigger type; the reading shows the triggerlevel value:

    - Rising edge or slope triggering.
    - Falling edge or slope triggering.
    - Pulse triggering.
    - Video line synchronous triggering.
    - Video field synchronous triggering.
18. The bottom menu bar.
19. The reading shows the setting of main time base.
20. The readings indicate the voltage division of corresponding channels.

    The icon shows the coupling mode and other settings of the channel:

    (DC coupling), (AC coupling), (Ground coupling), Ω (Impedance 50Ω), (Inverted), BW (Band Width 20M).
21. The readings show current sample rate and the record length.

22 It indicates the measured type and value of the corresponding channel. The measured type: F(Freq), T(Period), V(Mean), Vp(PK-PK), Vk(RMS), Ma(Max), Mi(Min), Vt(Vtop), Vb(Vbase), Va(Vamp), Os(Overshoot), Ps(Preshoot), RT(Rise Time), FT(Fall Time), PW(+Width), NW(-Width), +D(+Duty), -D(-Duty), 1→2 (Delay), 1→2 (Delay), 3→4 (Delay), 3→4 (Delay).

23 The green pointer indicates the grounding datum point (zero point position) of the waveform of the CH4 channel.

24 The purple pointer indicates the grounding datum point (zero point position) of the waveform of the CH3 channel.

25 The yellow pointer shows the grounding datum point (zero point position) of the waveform of the CH2 channel.

26 The blue pointer indicates the zero point position of the waveform of the Math.

27 The red pointer indicates the grounding datum point (zero point position) of the waveform of the CH1 channel.

2.3 How to Implement the General Inspection

After you get a new oscilloscope, it is recommended that you should make a check on the instrument according to the following steps:

► **Check whether there is any damage caused by transportation.**

If it is found that the packaging carton or the foamed plastic protection cushion has suffered serious damage, do not throw it away first till the complete device and its accessories succeed in the electrical and mechanical property tests.

► **Check the Accessories**

The supplied accessories have been already described in the "SPECIFICATIONS" of this Manual. You can check whether there is any loss of accessories with reference to this description. If it is found that there is any accessory lost or damaged, please get in touch with the distributor of PROMAX responsible for this service or the PROMAX local offices.

► **Check the Complete Instrument**

If it is found that there is damage to the appearance of the instrument, or the instrument can not work normally, or fails in the performance test, please get in touch with the PROMAX distributor responsible for this business or the PROMAX local offices. If there is damage to the instrument caused by the transportation, please keep the package. With the transportation department or the PROMAX distributor responsible for this business informed about it, a repairing or replacement of the instrument will be arranged by the PROMAX.

2.4 How to Implement the Function Inspection

Make a fast function check to verify the normal operation of the instrument, according to the following steps:

1 **Connect the power cord to a power source. Push down the button of the "⏻" signal on the left bottom.**

The instrument carries out all self-check items and shows the Boot Logo. Press the "**Utility**" button, select **Calibrate** in the left menu, select **Factory Set** in the bottom menu. The default attenuation coefficient set value of the probe in the menu is 10X.

2 **Set the Switch in the Oscilloscope Probe as 10X and Connect the Oscilloscope with CH1 Channel.**

Align the slot in the probe with the plug in the CH1 connector BNC, and then tighten the probe with rotating it to the right side.

Connect the probe tip and the ground clamp to the connector of the probe compensator.

3 **Press the "Autoset" Button.**

The square wave of 1 KHz frequency and 5V peak-peak value will be displayed in several seconds (see Figure 5).

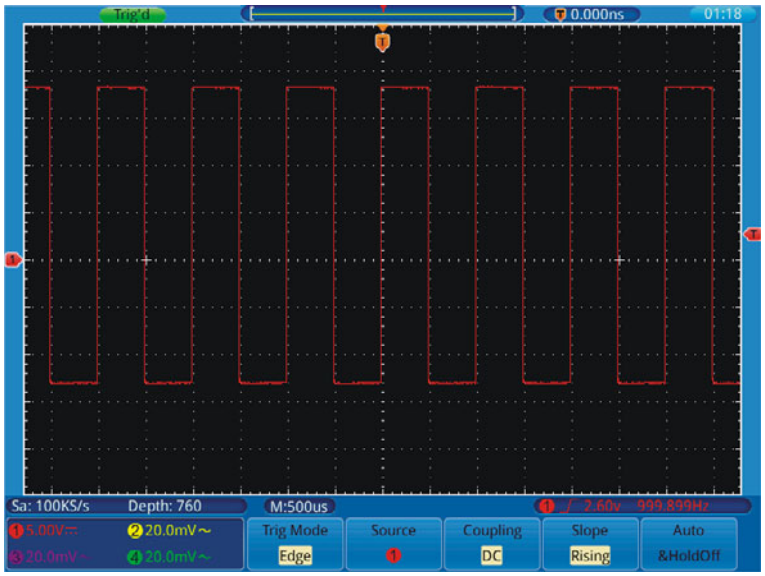


Figure 5. Auto set.

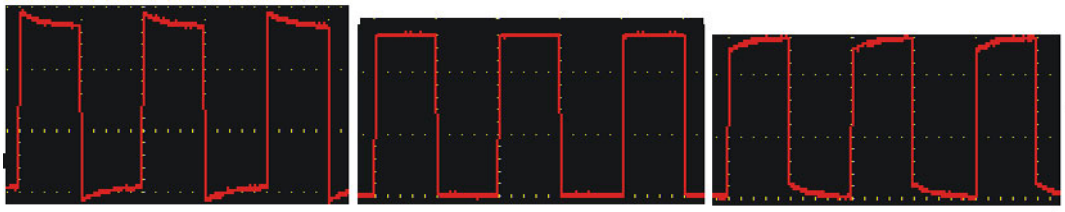
Check CH2, CH3 and CH4 by repeating Step 2 and Step 3.

2.5 How to Implement the Probe Compensation

When connect the probe with any input channel for the first time, make this adjustment to match the probe with the input channel. The probe which is not compensated or presents a compensation deviation will result in the measuring error or mistake. For adjusting the probe compensation, please carry out the following steps:

1. Set the attenuation coefficient of the probe in the menu as 10X and that of the switch in the probe as 10X, and connect the probe with the CH1 channel. If a probe hook tip is used, ensure that it keeps in close touch with the probe. Connect the probe tip with the signal connector of the probe compensator and connect the reference wire clamp with the ground wire connector of the probe connector, and then press the button "Autoset".

2. Check the displayed waveforms and regulate the probe till a correct compensation is achieved (see Figure 6 and Figure 7).



Overcompensated **Compensated correctly** **Under compensated**

Figure 6. Displayed Waveforms of the Probe Compensation.

3 Repeat the steps mentioned if needed.

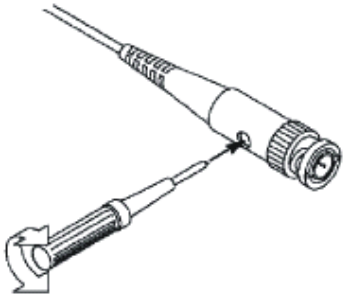


Figure 7. Adjust Probe.

2.6 How to Set the Probe Attenuation Coefficient

The probe has several attenuation coefficients, which will influence the vertical scale factor of the oscilloscope.

To change or check the probe attenuation coefficient in the menu of oscilloscope:

1 Press the function menu button of the used channels (**CH1~CH4 button**).

2 Select **Probe** in the bottom menu; select the proper value in the right menu corresponding to the probe.

This setting will be valid all the time before it is changed again.

CAUTION: The default attenuation coefficient of the probe on the instrument is preset to 10X. Make sure that the set value of the attenuation switch in the probe is the same as the menu selection of the probe attenuation coefficient in the oscilloscope.

The set values of the probe switch are 1X and 10X (see Figure 8).

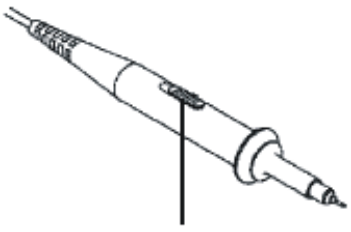


Figure 8. Attenuation Switch.

CAUTION: When the attenuation switch is set to 1X, the probe will limit the bandwidth of the oscilloscope in 5MHz. To use the full bandwidth of the oscilloscope, the switch must be set to 10X.

2.7 How to Use the Probe Safely

The safety guard ring around the probe body protects your finger against any electric shock, shown as Figure 9.

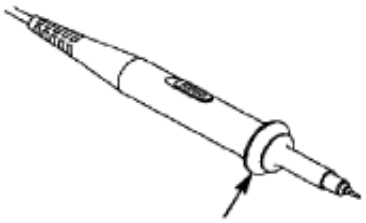


Figure 9. Finger Guard.

CAUTION: To avoid electric shock, always keep your finger behind the safety guard ring of the probe during the operation. To protect you from suffering from the electric shock, do not touch any metal part of the probe tip when it is connected to the power supply. Before making any measurements, always connect the probe to the instrument and connect the ground terminal to the earth.

2.8 How to Implement Self-calibration

The self-calibration application can make the oscilloscope reach the optimum condition rapidly to obtain the most accurate measurement value. You can carry out this application program at any time. This program must be executed whenever the change of ambient temperature is 5 ºC or over.

Before performing a self-calibration, disconnect all probes or wires from the input connector. Press the "**Utility**" button, select Calibrate in the left menu, select **Self Calibrate** in the bottom menu. A confirmation window will pop up, select **OK** after everything is ready.

2.9 Introduction to the Vertical System

As shown in Figure 10, there are a few of buttons and knobs in **VERTICAL CONTROLS**. The following practices will gradually direct you to be familiar with the using of the vertical setting.

Figure 10. Vertical Control Zone.

1 Use the button "**VERTICAL POSITION**" knob to show the signal in the center of the waveform window. The "**VERTICAL POSITION**" knob functions the regulating of the vertical display position of the signal. Thus, when the "**VERTICAL POSITION**" knob is rotated, the pointer of the earth datum point of the channel is directed to move up and down following the waveform.

► **Measuring Skill**

If the channel is under the DC coupling mode, you can rapidly measure the DC component of the signal through the observation of the difference between the wave form and the signal ground.

If the channel is under the AC mode, the DC component would be filtered out. This mode helps you display the AC component of the signal with a higher sensitivity.

► **Vertical offset back to 0 shortcut key**

Turn the **VERTICAL POSITION** knob to change the vertical display position of channel and press the position knob to set the vertical display position back to 0 as a shortcut key, this is especially helpful when the trace position is far out of the screen and want it to get back to the screen center immediately.

2 Change the Vertical Setting and Observe the Consequent State Information Change.

With the information displayed in the status bar at the bottom of the waveform window, you can determine any changes in the channel vertical scale factor.

- Turn the vertical "**VOLTS/DIV**" knob and change the "Vertical Scale Factor (Voltage Division)", it can be found that the scale factor of the channel corresponding to the status bar has been changed accordingly.

- Press buttons of **CH1 ~ CH4** and **Math**, the operation menu, symbols, waveforms and scale factor status information of the corresponding channel will be displayed in the screen.

You can also set the vertical system through touchscreen, see "Set the Vertical System through touchscreen".

2.10 Introduction to the Horizontal System

Shown as Figure 11, there are a button and two knobs in the "**HORIZONTAL CONTROLS**". The following practices will gradually direct you to be familiar with the setting of horizontal time base.

Figure 11. Horizontal Control Zone.

1 Use the horizontal "**SEC/DIV**" knob to change the horizontal time base setting and observe the consequent status information change. Rotate the horizontal "**SEC/DIV**" knob to change the horizontal time base, and it can be found that the "**Horizontal Time Base**" display in the status bar changes accordingly.

2 Use the "**HORIZONTAL POSITION**" knob to adjust the horizontal position of the signal in the waveform window. The "**HORIZONTAL POSITION**" knob is used to control the triggering displacement of the signal or for other special applications. If it is applied to triggering the displacement, it can be observed that the waveform moves horizontally with the knob when you rotate the "**HORIZONTAL POSITION**" knob.

► **Triggering displacement back to 0 shortcut key**

Turn the **HORIZONTAL POSITION** knob to change the horizontal position of channel and press the **HORIZONTAL POSITION** knob to set the triggering displacement back to 0 as a shortcut key.

3 With the "**HORIZ MENU**" button, you can do the Window Setting and the Window Expansion.

2.11 Introduction to the Trigger System

As shown in Figure 12, there are one knob and three buttons make up "**TRIGGER CONTROLS**". The following practices will direct you to be familiar with the setting of the trigger system gradually.

Figure 12. Trigger Control Zone.

1 Press the "**Trigger Menu**" button and call out the trigger menu. With the operations of the menu selection buttons, the trigger setting can be changed.

2 Use the "**TRIG LEVEL**" knob to change the trigger level setting.

By rotating the "**TRIG LEVEL**" knob, the trigger indicator in the screen will move up and down. With the movement of the trigger indicator, it can be observed that the trigger level value displayed in the screen changes accordingly.

PS: Turning the **TRIG LEVEL** knob can change trigger level value and it is also the hotkey to set trigger level back to 0.

3 Press the button "**50%**" to set the trigger level as the vertical mid point values of the amplitude of the trigger signal.

4 Press the "**Force**" button to force a trigger signal, which is mainly applied to the "Normal" and "Single" trigger modes.

2.12 Introduction to the Touchscreen Controls

When **Gesture** is ON, which is set in menu **Utility**->**Display**->**Gesture**, you can control the oscilloscope by touching different areas of the screen. You can also use the buttons / knobs enclosed in brackets to do the same thing.

2.12.1 Set the Vertical System through touchscreen

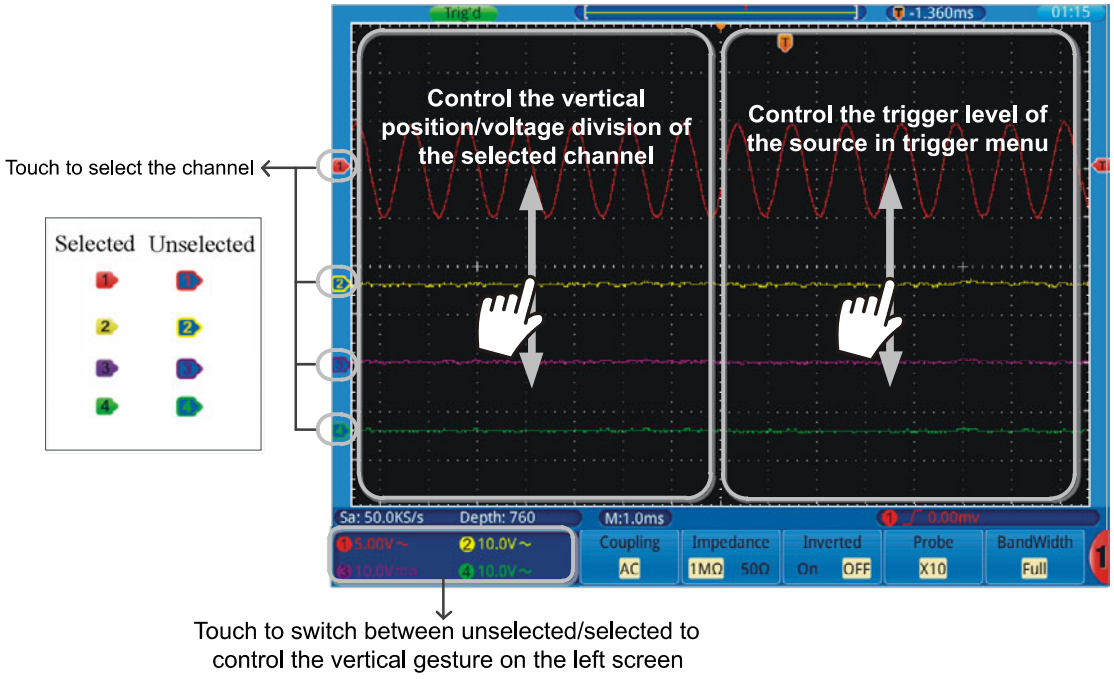

Control the vertical position/voltage division of the selected channel
Control the trigger level of the source in trigger menu
Touch to select the channel
Selected Unselected
Touch to switch between unselected/selected to control the vertical gesture on the left screen

Figure 13.

► **Select a channel** (**CH1~CH4** buttons)
Touch the pointer on the left side of corresponding channel to make it in selected state.

► **Set the vertical position of the selected channel** (**VERTICAL POSITION** knob): Unselect the channel window, drag your finger up or down across the left half of the screen.

- **Set the voltage division of the selected channel** (vertical **VOLTS/DIV** knob): Select the channel window (bordered), drag your finger up or down across the left half of the screen.

- **Set the trigger level of the source in trigger menu** (**TRIG LEVEL** knob): Drag your finger up or down across the right half of the screen.

2.12.2 Set the Horizontal System through touchscreen

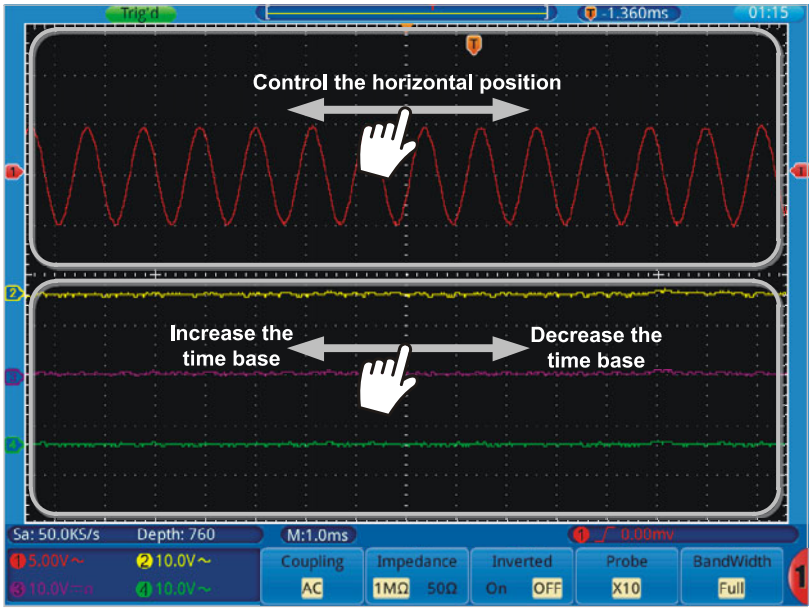


Figure 14.

- **Set the horizontal position** (**HORIZONTAL POSITION** knob): Drag your finger left or right across the top half of the screen.

- **Set the horizontal time base** (horizontal **SEC/DIV** knob): Drag your finger left or right across the bottom half of the screen.

2.12.3 Zoom the Waveform through Touchscreen

Press the **Horiz** button, the display divides in half. The top half of the display shows the Main window and the bottom half displays the Zoom window.

► Vertical Operations

The vertical operations in Main/Zoom window are the same as in normal mode.

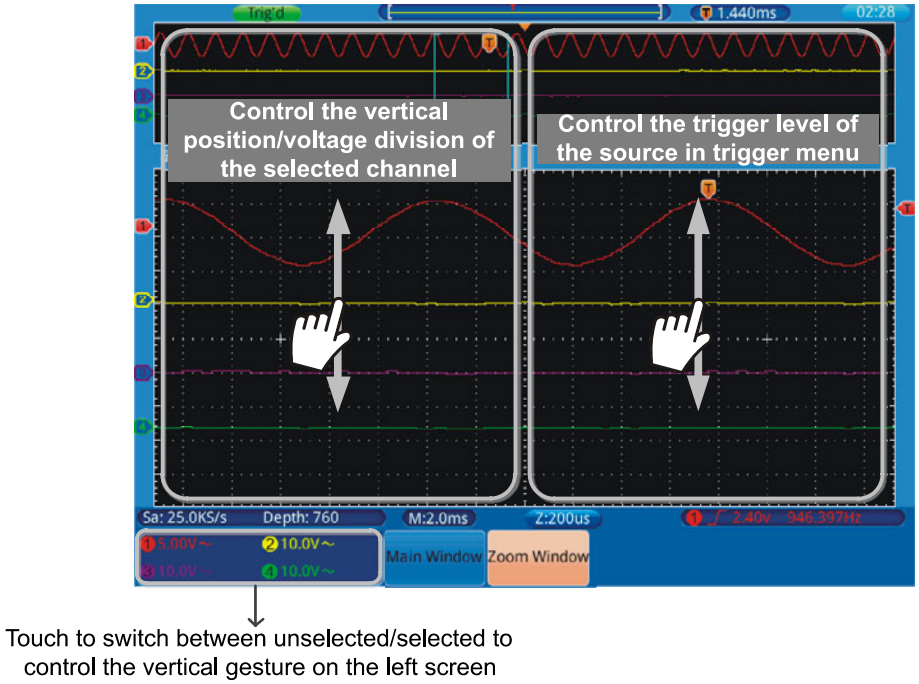


Figure 15.

► Horizontal Operations

When **Zoom Window** in the bottom menu is selected, the horizontal operations using touchscreen are shown in the figure below:

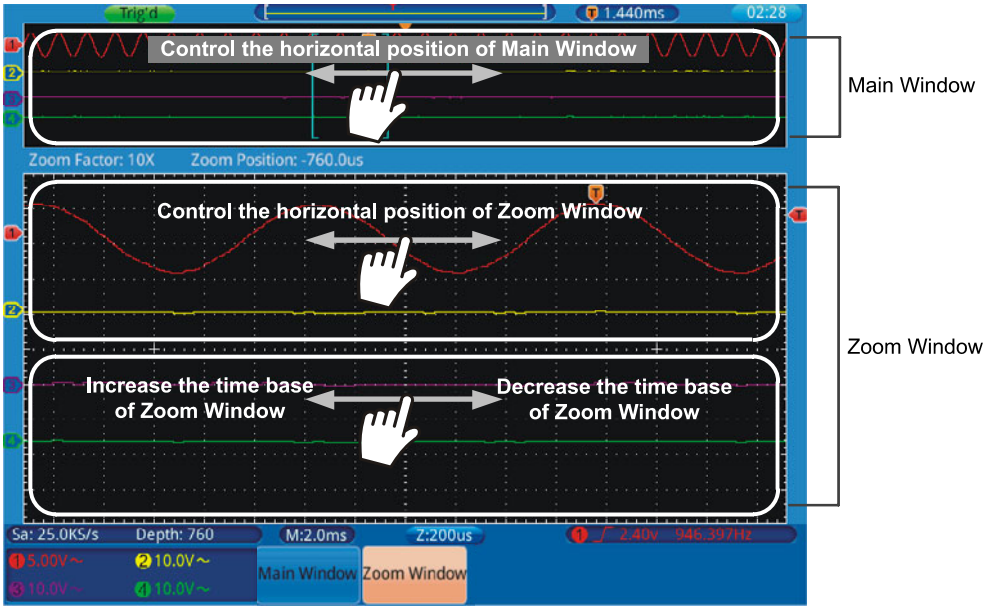


Figure 16.

When **Main Window** in the bottom menu is selected, the horizontal operations using touchscreen are shown in the figure below:

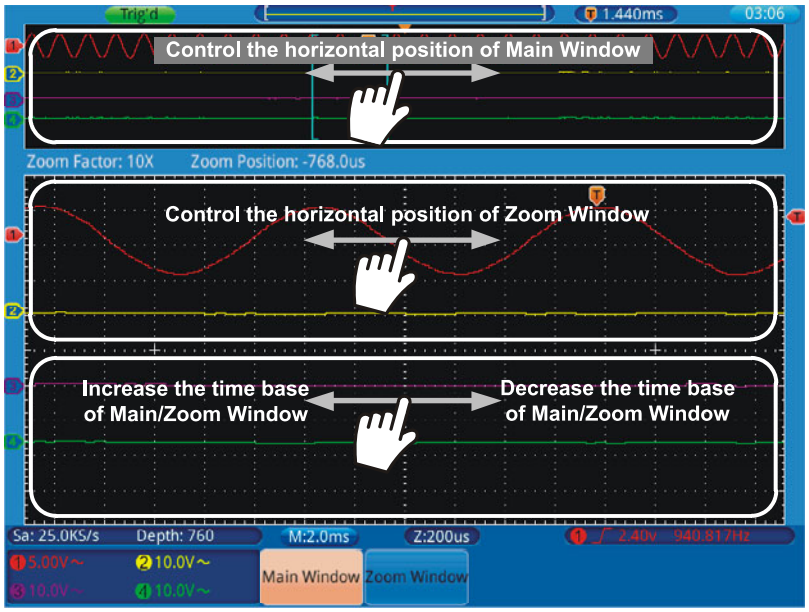


Figure 17.

2.12.4 Operate the Menu through Touchscreen or Buttons/Knob

► Select a menu item

Touch the menu items in the bottom menu (H1~H5 buttons), or in the right menu (F1~F5 buttons), or in the left menu (G knob).

► Switch menu items:

If there are options that can be switched in the menu, you can repeatedly touch the area of the menu item to switch, or press the corresponding button to switch. See figure below:

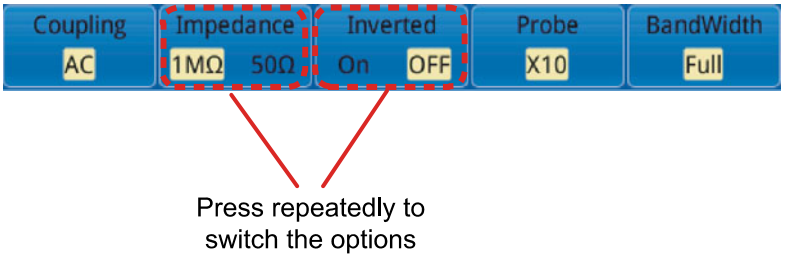


Figure 18.

► **Scroll the list:**

If there is a scroll bar in the left menu or in the file system window, you can drag your finger up and down to scroll the list.

NOTE: When a G symbol appears in the menu, it indicates you can turn the G knob to select the menu item or set the value.
When there is in the menu, select it to return to the main menu.

2.12.5 Other operations using touchscreen

► **Display the Measure Menu** (**Measure** button):

Touch the measure window to display the Measure Menu in the bottom menu.

► **Display the Cursor Measure Menu** (**Cursor** button):

Touch the cursor measure window to display the Cursor Measure Menu in the bottom menu.

► **Set the system time:**

Touch the time in the top right corner of the screen to display the time setting window.

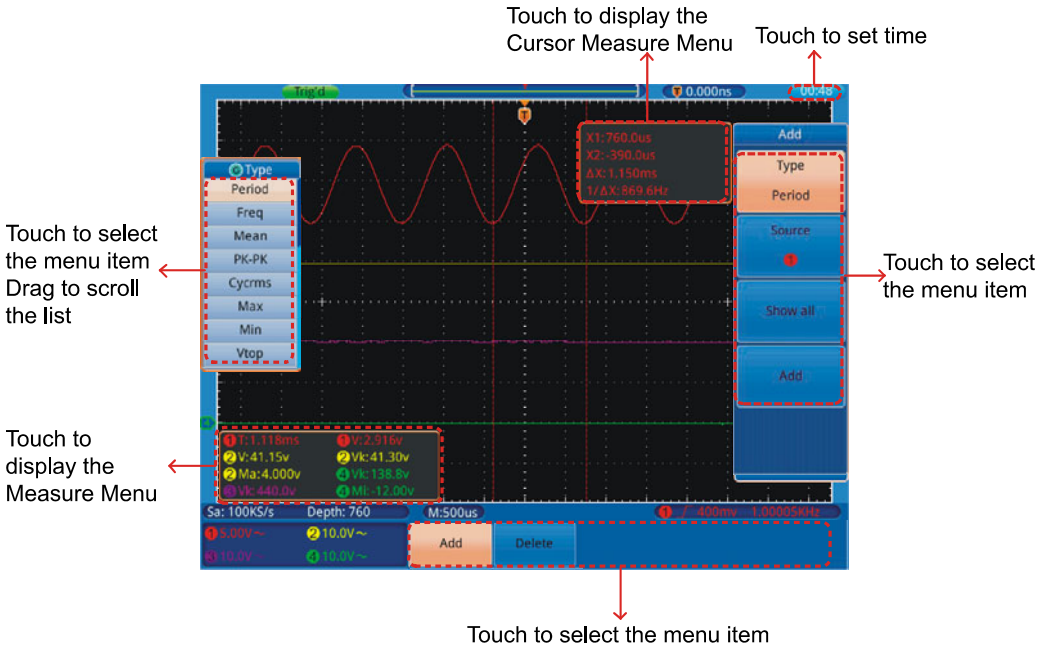

Touch to display the Cursor Measure Menu
Touch to set time
Touch to select the menu item Drag to scroll the list
Touch to select the menu item
Touch to display the Measure Menu
Touch to select the menu item

Figure 19.

3 ADVANCED USER GUIDEBOOK

Up till now, you have already been familiar with the basic operations of the function areas, buttons and knobs in the front panel of the oscilloscope. Based the introduction of the previous Chapter, the user should have an initial knowledge of the determination of the change of the oscilloscope setting through observing the status bar. If you have not been familiar with the above-mentioned operations and methods yet, we advise you to read the section of Chapter 2 "Junior User Guidebook".

This chapter will deal with the following topics mainly:

- How to Set the Vertical System.
- Use Mathematical Manipulation Function.
- How to Set the Horizontal System.
- How to Set the Trigger System.
- How to Implement the Sampling Setup.
- How to Set the Display System.
- How to Save and Recall.
- How to Implement the Auxiliary System Function Setting.
- How to Implement the Automatic Measurement.
- How to Implement the Cursor Measurement.
- How to Use Autoscale function.
- How to Use Executive Buttons.

It is recommended that you read this chapter carefully to get acquainted the various measurement functions and other operation methods of the TDS series oscilloscope.

3.1 How to Set the Vertical System

The **VERTICAL CONTROLS** includes three menu buttons such as **CH1 ~ CH4** and **Math**, and four knobs such as **VERTICAL POSITION**, **VOLTS/DIV** for each channel.

- **Setting of CH1 ~ CH4**

  Each channel has an independent vertical menu and each item is set respectively based on the channel.

► **To turn waveforms on or off (channel, math)**

Pressing the **CH1 ~ CH4** or **Math** buttons have the following effect:

- If the waveform is off, the waveform is turned on and its menu is displayed.
- If the waveform is on and its menu is not displayed, its menu will be displayed.
- If the waveform is on and its menu is displayed, the waveform is turned off and its menu goes away.

Figure 20. Channel Setting Menu.

The description of the Channel Menu is shown as the following list:

Function Menu	Setting	Description
Coupling	DC AC GROUND	Pass both AC and DC components of the input signal. Block the DC component of the input signal. Disconnect the input signal.
Impedance	1 MΩ 50 Ω	Select the input impedance to use. When 50Ω is selected, AC in coupling is not available. If the impedance is set to 50Ω when using AC coupling, the coupling will be set to DC automatically.
Inverted	ON OFF	Display inverted waveform. Display original waveform.
Probe	X1 X10 X100 X1000	Match this to the probe attenuation factor to have an accurate reading of vertical scale.
Limit	Full 20M	Get full bandwidth. Limit the channel bandwidth to 20MHz to reduce display noise.

► **To set channel coupling**

Taking the Channel 1 for example, the measured signal is a square wave signal containing the direct current bias. The operation steps are shown as below:

1. Press the **CH1** button show channel.
2. Select **Coupling** in the bottom menu.

3 Select **DC** in the right menu. Both DC and AC components of the signal are passed.

4 Select **AC** in the right menu. The direct current component of the signal is blocked.

► **To adjust the probe attenuation**

For correct measurements, the attenuation coefficient settings in the operating menu of the Channel should always match what is on the probe (see "*How to Set the Probe Attenuation Coefficient*"). If the attenuation coefficient of the probe is 1:1, the menu setting of the input channel should be set to X1.

Take the Channel 1 as an example, the attenuation coefficient of the probe is 10:1, the operation steps is shown as follows:

1 Press the **CH1** button to show menu.

2 Select **Probe** in the bottom menu. Select **×10** in the right menu.

A list of the probe attenuation coefficient and the corresponding menu settings:

Attenuation Coefficient of the Probe	Corresponding Menu Setting
1:1	X1
10:1	X10
100:1	X100
1000:1	X1000

► **To invert a waveform**

Waveform inverted: the displayed signal is turned 180 degrees against the phase of the earth potential.

Taking the Channel 1 for example, the operation steps are shown as follows:

1 Press the **CH1** button to show channel menu.

2 Select **ON** for **Inverted** item. The waveform is inverted.

3 Select **OFF** for **Inverted** item. The waveform goes back to its original one.

► **To set bandwidth limit**

When high frequency components of a waveform are not important to its analysis, the bandwidth limit control can be used to reject frequencies above 20 MHz.

Taking the Channel 1 for example, the operation steps are shown as below:

1. Press the **CH1** button to show menu.
2. Select **BandWidth** in the bottom menu.
3. Select **Full** in the right menu. The high frequency of the signal will be allowed to pass.
4. Select **20M** in the right menu. The bandwidth is limited to 20MHz. The frequencies above 20MHz will be rejected.

3.1.1 Use Mathematical Manipulation Function

The **Mathematical Manipulation** function is used to show the results of the addition, multiplication, division and subtraction operations between two channels, or the FFT operation for a channel. Press the **Math** button to display the menu on the bottom.

The corresponding FCL (Functional Capabilities List) of the **Waveform Calculation:**

Function Menu		Setting	Description
Dual Wfm Math	Factor1	① ② ③ ④	Select the signal source of the factor1.
	Sign	+ - x /	Select the sign of mathematical manipulation.
	Factor2	① ② ③ ④	Select the signal source of the factor2.
	Vertical	div voltage	Switch to select the vertical position or voltage division of the Math waveform, turn the G knob to adjust it

FFT	Source	① ② ③ ④	FFT source.
	Window	Rectangle Hanning Hamming Blackman Bartlett Kaiser	Select window for FFT.
	Format	Vrms dB	Select Vrms for Format. Select dB for Format.
	Horizontal	Hz Hz/div	Switch to select the horizontal position or time base of the FFT waveform, turn the G knob to adjust it.
	Vertical	div v or dB	Switch to select the vertical position or voltage division of the FFT waveform, turn the G knob to adjust it.

Taking the additive operation between Channel 1 and Channels 2 for example, the operation steps are as follows:

1. Press the **Math** button to display the math menu in the bottom. The blue M waveform appears on the screen.
2. Select **Dual Wfm Math** in the bottom menu.
3. Select **Factor1** in the right menu; select ① in the left source menu.
4. Select **Operator** as **+** in the right menu.
5. Select **Factor2** in the right menu; select ② in the left source menu.
6. Select **Vertical** in the right menu; select repeatedly to make the symbol in front of **div**, turn the G knob to adjust the vertical position of Math waveform; then select to make the symbol in front of the voltage below, turn the G knob to adjust the voltage division of Math waveform.

3.1.2 Using FFT function

The FFT (fast Fourier transform) math function mathematically converts a time-domain waveform into its frequency components. It is very useful for analyzing the input signal on Oscilloscope. You can match these frequencies with known system frequencies, such as system clocks, oscillators, or power supplies.

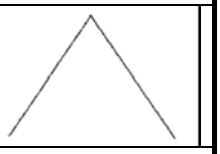
Taking the FFT operation for example, the operation steps are as follows:

1. Press the **Math** button to display the math menu in the bottom. The blue M waveform appears on the screen.
2. Select **FFT** in the bottom menu.
3. Select **Source** in the right menu; select ① in the left source menu.
4. Select **Window** in the right menu; select the proper window type in the left menu.
5. Select **Format** as Vrms or dB in the right menu.
6. Select **Horizontal** in the right menu; select repeatedly to make the G symbol in front of **Hz**, turn the **G** knob to adjust the horizontal position of FFT waveform; then select to make the G symbol in front of the **Hz/div** below, turn the **G** knob to adjust the time base of FFT waveform.
7. Select **Vertical** in the right menu; do the same operations as above to set the vertical position and voltage division.

► **To select the FFT window**

There are 6 FFT windows. Each one has trade-offs between frequency resolution and magnitude accuracy. What you want to measure and your source signal characteristics help you to determine which window to use. Use the following guidelines to select the best window.

Type	Characteristics	Window
Rectangle	Best solution for frequency, worst for magnitude. Best type for measuring the frequency spectrum of non repetitive signals and measuring frequency components near DC. Recommend to use for: ■ Transients or bursts, the signal level before and after the event are nearly equal. ■ Equal-amplitude sine waves with frequencies those are very close. ■ Broadband random noise with a relatively slow varying spectrum.	
Hanning	Good for magnitude, but poorer frequency resolution than Hamming. Recommend to use for: ■ Sine, periodic and narrow band random noise. ■ Transients or bursts where the signal levels before and after the event are significantly different.	
Hamming	Better solution for magnitude than Rectangle, and good for frequency as well. It has slightly better frequency resolution than Hanning. Recommend to use for: ■ Sine, periodic and narrow band random noise. ■ Transients or bursts where the signal levels before and after the event are significantly different.	

Type	Characteristics	Window
Blackman	Best solution for magnitude, worst for frequency. Recommend to use for: ■ Single frequency waveforms, to find higher order harmonics.	
Bartlett	The Bartlett window is a slightly narrower variant of the triangular window, with zero weight at both ends.	
Kaiser	The frequency resolution when using the Kaiser window is fair; the spectral leakage and amplitude accuracy are both good. The Kaiser window is best used when frequencies are very close to the same value but have widely differing amplitudes (the side lobe level and shape factor are closest to the traditional Gaussian RBW). s window is also good for random signals.	

► **Notes for using FFT**

- Use Zoom function to magnify the FFT waveform if necessary. see "Zoom the Waveform".
- Use the default **dB** scale for details of multiple frequencies, even if they have very different amplitudes. Use the **Vrms** scale to compare frequencies.
- DC component or offset can cause incorrect magnitude values of FFT waveform. To minimize the DC component, choose AC Coupling on the source signal.
- To reduce random noise and aliased components in repetitive or single-shot events, set the oscilloscope acquisition mode to average.

► **What is Nyquist frequency?**

The Nyquist frequency is the highest frequency that any real-time digitizing oscilloscope can acquire without aliasing. This frequency is half of the sample rate. Frequencies above the Nyquist frequency will be under sampled, which causes aliasing. So pay more attention to the relation between the frequency being sampled and measured.

3.2 Use VERTICAL POSITION and VOLTS/DIV Knobs

1 The **VERTIVAL POSITION** knob is used to adjust the vertical positions of the waveforms. When turning this knob, the information of vertical position will be displayed on the bottom left of the waveform display area; it will disappear after stopping turning the knob.

The analytic resolution of this control knob changes with the vertical division

2 The **VOLTS/DIV** knob is used to regulate the vertical resolution of the captured waveforms. The sensitivity of the vertical division steps as 1-2-5. The information of voltage division is displayed in channel window on the bottom left of the screen.

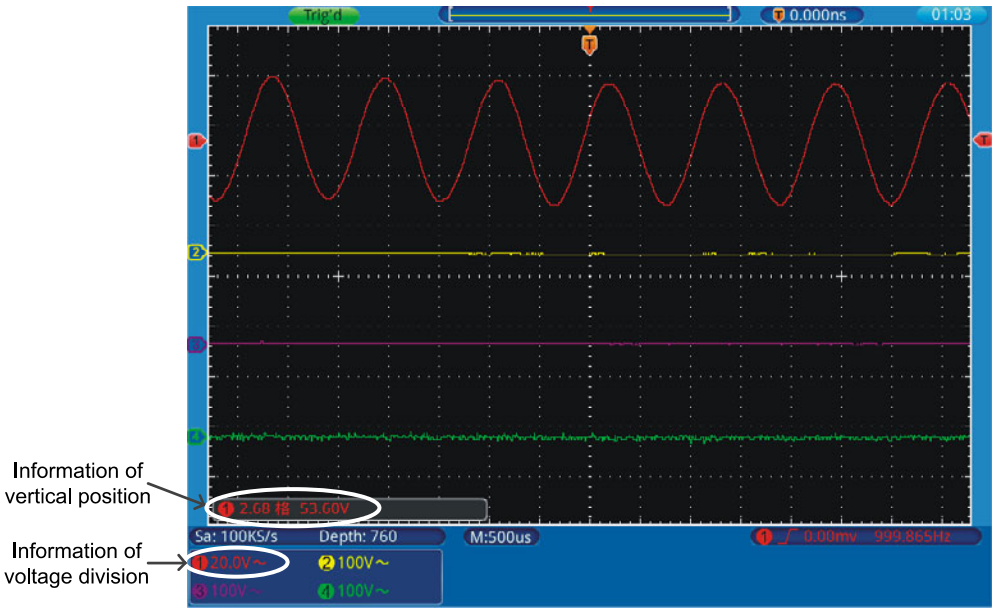


Figure 21. Vertical Information.

3.3 How to Set the Horizontal System

The **HORIZONTAL CONTROLS** includes the **Horiz** button and such knobs as **HORIZONTAL POSITION** and **SEC/DIV**.

1. **HORIZONTAL POSITION** knob: this knob is used to adjust the horizontal positions of 4 channels the analytic resolution of which changes with the time base.

2. **SEC/DIV** knob: it is used to set the horizontal scale factor in the main window or the zoom window.

3. **Horiz** button: View the waveform in zoom mode and analyze the detail of the signal. For more detailed operations, see the introductions below.

3.3.1 Zoom the Waveform

Press the **Horiz** button, the display divides in half. The top half of the display shows the Main window and the bottom half displays the Zoom window. The Zoom window is a magnified portion of the Main window.

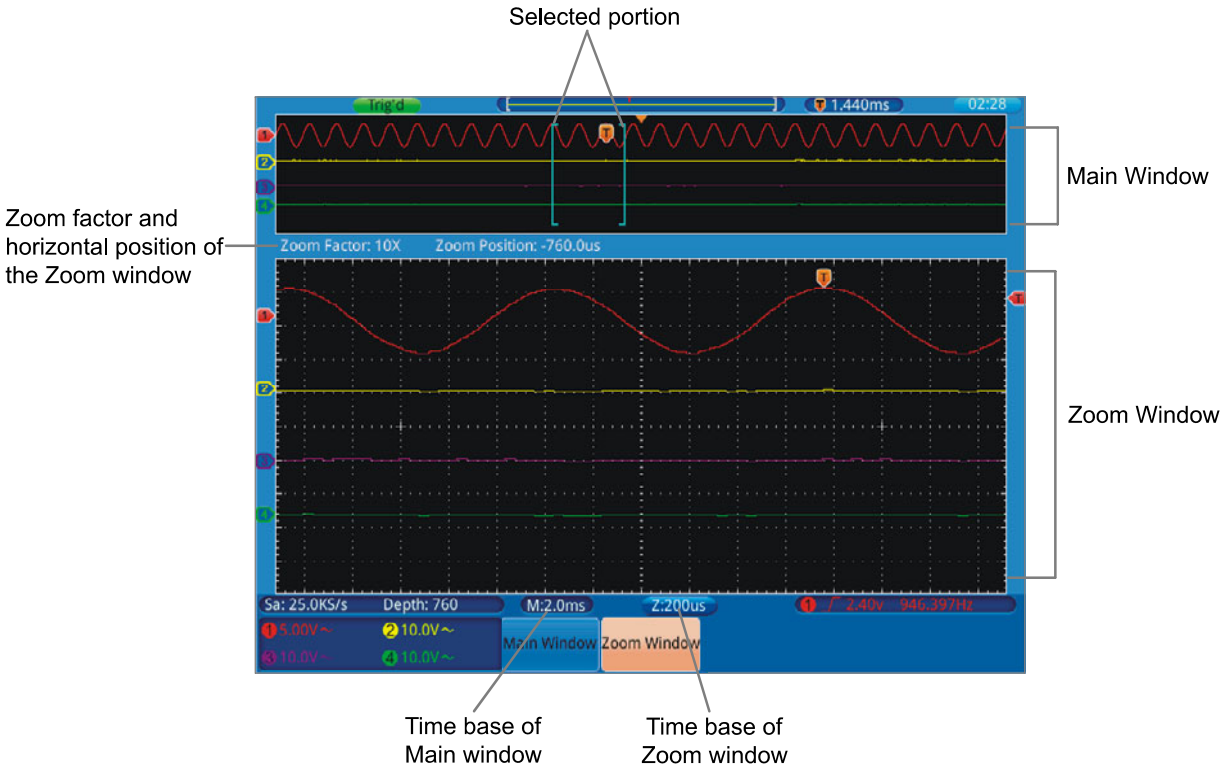


Figure 22.

- When **Main Window** is selected in the bottom menu, the **HORIZONTAL POSITION** and **SEC/DIV** knobs are used to adjust the horizontal position and time base of the Main window. The time base of Zoom window is changed as well.

- When **Zoom Window** is selected in the bottom menu, the **HORIZONTAL POSITION** and **SEC/DIV** knobs are used to adjust the horizontal position and time base of the Zoom window.

NOTE: When the time base of the Zoom window is same as the Main window, the interface will get back to the normal mode automatically, the zoom mode will be turned off.

You can also zoom the waveform through touchscreen, see "Zoom the Waveform through Touchscreen".

3.4 How to Set the Trigger System

Trigger determines when TDS starts to acquire data and display waveform. Once trigger is set correctly, it can convert the unstable display to meaningful waveform.

When TDS starts to acquire data, it will collect enough data to draw waveform on left of trigger point. TDS continues to acquire data while waiting for trigger condition to occur. Once it detects a trigger it will acquire enough data continuously to draw the waveform on right of trigger point.

Trigger control area consists of 1 knob and 3 menu keys.

- **TRIG LEVEL**: The knob that set the trigger level; press the knob and the level will be cleaned to Zero.
- **50%**: The instant execute button setting the trigger level to the vertical midpoint between the peaks of the trigger signal.
- **Force**: Force to create a trigger signal and the function is mainly used in "Normal" and "Single" mode.
- **Trigger Menu**: The button that activates the trigger control menu.

- **TERM INTERPRETATION**

► **Source**

Trigger can occur from several sources: Input channels (CH1~CH4), AC Line.

- **Input**: It is the most commonly used trigger source. The channel will work when selected as a trigger source whatever displayed or not.
- **AC Line**: AC power can be used to display signals related to the power line frequency, such as lighting equipment and power supply devices. The oscilloscope gets triggered on its power cord, so you do not have to input an AC trigger signal. When AC Line is selected as trigger source, the oscilloscope automatically set coupling to DC, set trigger level to 0V.

► **Trigger Mode**

The trigger mode determines how the oscilloscope behaves in the absence of a trigger event. The oscilloscope provides three trigger modes: Auto, Normal, and Single.

- **Auto**: This sweep mode allows the oscilloscope to acquire waveforms even when it does not detect a trigger condition. If no trigger condition occurs while the oscilloscope is waiting for a specific period (as determined by the time-base setting), it will force itself to trigger.
- **Normal:** The Normal mode allows the oscilloscope to acquire a waveform only when it is triggered. If no trigger occurs, the oscilloscope keeps waiting, and the previous waveform, if any, will remain on the display. Single: In Single mode, after pressing the **Run/Stop** key, the oscilloscope waits for trigger. While the trigger occurs, the oscilloscope acquires one waveform then stop.
- **Single:** In Single mode, after pressing the **Run/Stop** key, the oscilloscope waits for trigger. While the trigger occurs, the oscilloscope acquires one waveform then stop.

► **Coupling**

Trigger coupling determines what part of the signal passes to the trigger circuit. Coupling types include AC, DC, LF Reject and HF Reject.

- **AC**: AC coupling blocks DC components.
- **DC**: DC coupling passes both AC and DC components.
- **LF Reject**: LF Reject coupling blocks DC component, and attenuates all signal with a frequency lower than 8 kHz.
- **HF Reject:** HF Reject coupling attenuates all signals with a frequency higher than 150 kHz.

► **Holdoff:**

Trigger holdoff can be used to stabilize a waveform. The holdoff time is the oscilloscope's waiting period before starting a new trigger. The oscilloscope will not trigger until the holdoff time has expired. It provides a chance for user to check the signal in a short period and helps to check some complex signals, such as AM waveform etc.

► **Trigger Control:**

- **Trigger**: Use a trigger level to capture stable waveforms in two channels simultaneously.

Trigger has four modes: edge trigger, video trigger, slope trigger and pulse trigger.

- **Edge Trigger**: It occurs when the trigger input passes through a specified voltage level with the specified slope. Trigger on non-synchronized signals.
- **Video Trigger**: Trigger on fields or lines for standard video signal.
- **Slope Trigger**: The oscilloscope begins to trigger according to the signal rising or falling speed.
- **Pulse Trigger**: Find pulses with certain widths.

The four trigger modes in Trigger are described respectively as follows:

3.4.1 Edge Trigger

An edge trigger occurs on trigger threshold value of input signal. Select Edge trigger mode to trigger on rising edge or falling edge.

The description of the Edge Trigger Menu is as follows:

Menu	Settings	Instruction
Trigger Mode	Edge	Set vertical channel trigger type as edge trigger.
Source	①	Channel 1 as trigger signal.
	②	Channel 2 as trigger signal.
	③	Channel 3 as trigger signal.
	④	Channel 4 as trigger signal.
	AC	AC power line as trigger signal.

Menu	Settings	Instruction
Coupling	AC	Block the direct current component.
	DC	Allow all component pass.
	HF	Block the high-frequency signal, only low-frequency component pass.
	LF	Block the low-frequency signal, only high-frequency component pass.
Slope	Rising	Trigger on rising edge.
	Falling	Trigger on falling edge.
Mode Holdoff	Auto	Acquire waveform even no trigger occurs.
	Normal	Acquire waveform when trigger occurs.
	Single	When trigger occurs, acquire one waveform then stop.
	Holdoff	100ns~10s, turn **G** knob to set time interval before another trigger occur.
	Reset	Set Holdoff time as default value (100ns).

3.4.2 Video Trigger

Choose video trigger to trigger on fields or lines of NTSC, PAL or SECAM standard video signals.

The description of the **Video Trigger Menu** is as follows:

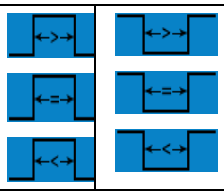
Menu	Settings	Instruction
Trigger Mode	Video	Set vertical channel trigger type as video trigger.
Source	①	Channel 1 as trigger signal.
	②	Channel 2 as trigger signal.
	③	Channel 3 as trigger signal.
	④	Channel 4 as trigger signal.
Modu	NTSC PAL SECAM	Select video modulation.
Sync	Line	Synchronic trigger in video line.
	Field	Synchronic trigger in video field.
	Odd	Synchronic trigger in video odd filed.
	Even	Synchronic trigger in video even field.
	Line NO.	Synchronic trigger in designed video line, turn the **G** knob to set the line number.

Menu	Settings	Instruction
Mode	Auto	Acquire waveform even no trigger occurred.
	Holdoff	100ns~10s, adjust the **G** knob to set time interval before another trigger occur.
Holdoff	Reset	Set Holdoff time as 100ns.

3.4.3 Pulse Width Trigger

Pulse trigger occurs according to the width of pulse. The abnormal signals can be detected through setting up the pulse width condition.

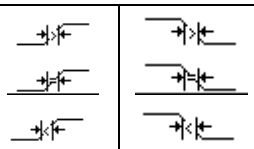
The description of the Pulse Width Trigger Menu is as follows:

Menu	Settings	Instruction
Trigger Mode	Pulse	Set vertical channel trigger type as pulse trigger.
Source	①	Channel 1 as trigger signal.
	②	Channel 2 as trigger signal.
	③	Channel 3 as trigger signal.
	④	Channel 4 as trigger signal.
Coupling	AC	Not allow DC portion to pass.
	DC	Allow all portion pass.
	HF	Not allow high frequency of signal pass and only low frequency portion pass.
	LF	Not allow low frequency of signal pass and only high frequency portion pass.
When	Polarity	Choose the polarity.
		Select pulse width condition and adjust the G knob to set time.
Mode	Auto	Acquire waveform even no trigger occurred.
	Normal	Acquire waveform when trigger occurred.
	Single	When trigger occurs, acquire one waveform then stop.
Holdoff	Holdoff	100ns~10s, turn the **G** knob to set time interval before another trigger occur.
	Reset	Set Holdoff time as 100ns.

3.4.4 Slope Trigger

Slope trigger sets the oscilloscope as the positive/negative slope trigger within the specified time.

The description of the **Slope Trigger Menu** is as follows:

Menu	Settings	Instruction
Trigger Mode	Slope	Set vertical channel trigger type as pulse trigger.
Source	①	Channel 1 as trigger signal.
	②	Channel 2 as trigger signal.
	③	Channel 3 as trigger signal.
	④	Channel 4 as trigger signal.
when	slope	Slope selecting.
		Set slope condition; turn the G knob to set slope time.
	Slew Rate	Slew Rate = (High level - Low level) / Settings
Threshold &SlewRate	High level	Adjust **G** knob to set the High level upper limit.
	Low level	Adjust **G** knob to set Low level lower limit.
	Slew Rate	Slew Rate = (High level - Low level) / Settings
Mode Holdoff	Auto	Acquire waveform even no trigger occurred
	Normal	Acquire waveform when trigger occurred
	Single	When trigger occurs, acquire one waveform then stop
	Holdoff	100ns ~ 10s, turn the G knob to set time interval before another trigger occur.
	Reset	Set Holdoff time as 100ns

3.5 How to Operate the Function Menu

The function menu control zone includes 6 function menu buttons: **Utility**, **Measure**, **Cursor**, **Acquire**, **Save**, **Autoscale** and 4 immediate-execution buttons: **Autoset**, **Run/Stop**, **Single**, **Copy**.

3.5.1 How to Implement Sampling Setup

Press the **Acquire** button; select **Mode** or **Length** to set sampling.

The description of the **Mode** menu is shown as follows:

Function Menu	Setting	Description
Sample		Normal sampling mode.
Peak detect		Use to capture maximal and minimal samples. Finding highest and lowest points over adjacent intervals. It is used for the detection of the jamming burr and the possibility of reducing the confusion.
Average	4, 8, 16, 32, 64,128, 256, 512	It is used to reduce the random and don't care noises, with the optional number of averages.

The description of the **Length** menu is shown as follows:

Function Menu	Setting	Description
Length	760	Choose the record length.
	7.6K	
	76K	
	760K	
	7.6M	

Change the **Mode** settings and observe the consequent variation of the wave form displayed.

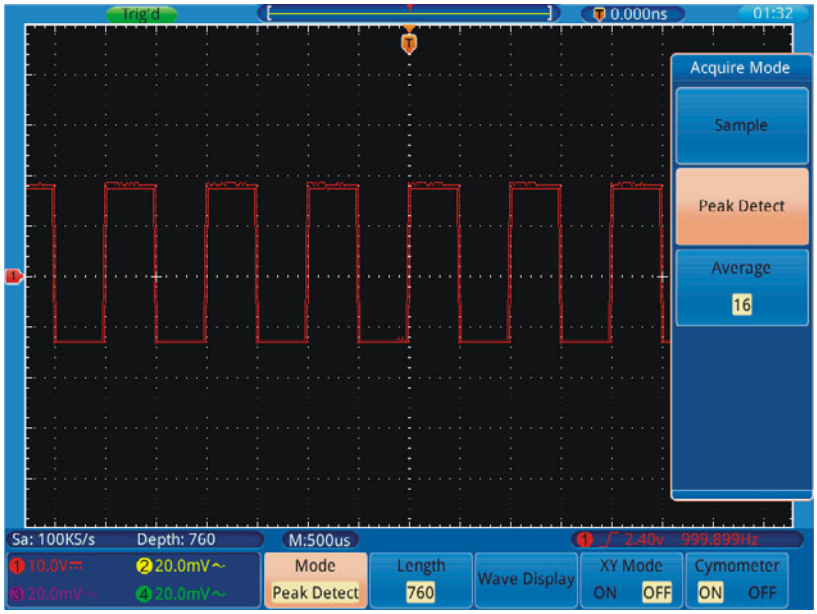


Figure 23. Peak Detect mode, under which the burrs on the falling edge of the square wave, can be detected and the noise is heavy.

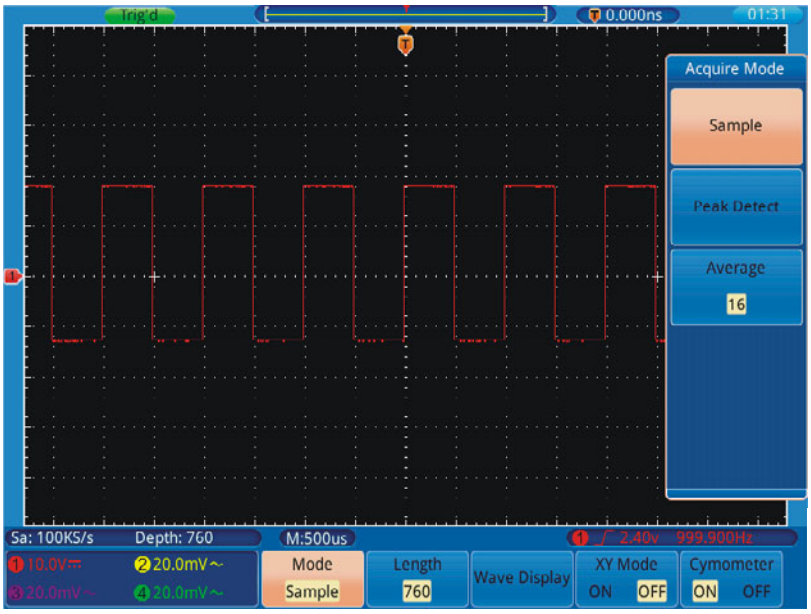


Figure 24. Normal **ACQU Mode** display, in which no burr can be detected.

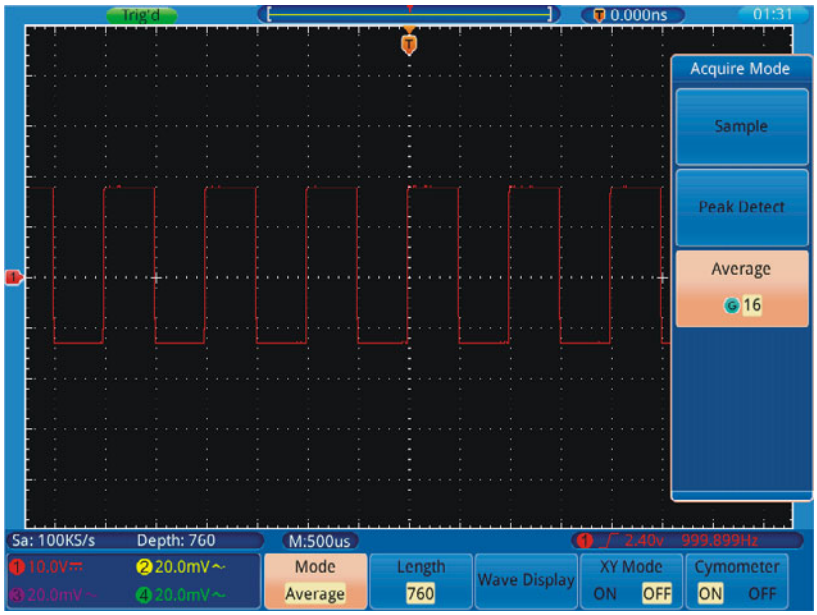


Figure 25. The displayed waveform after the noise is removed under the Average Mode, in which the average number of 16 is set.

3.5.2 How to Set the Display System

Press the **Acquire** button; select **Wave Display**, **XY Mode** or **Cymometer** to set the display system.

The description of the **Display Set Menu** is shown as follows:

Function Menu		Setting	Description
Wave Display	Type	Dots Vect	Only the sampling points are displayed. The space between the adjacent sampling points in the display is filled with the vector form.
	Persist Time	OFF 100ms 200ms … 9.9s 10s Infinity	Turn the **G** knob to set the persistence time.
	Persistence OFF		Turn off persistence and clear the display.
	Clear		Erase the results of previous acquisitions from the display. The oscilloscope will start to accumulate acquisitions again.
XY Mode		ON OFF	Turn on the XY display function; Turn off the XY display function.
Cymometer		ON OFF	Turn on the cymometer. Turn off the cymometer.

► **Display Type**

Press the **Acquire** button; select **Wave Display** in the bottom menu, select **Type** in the right menu. You can switch between **Dots** and **Vect**.

► **Persist**

When the **Persist** function is used, the persistence display effect of the picture tube oscilloscope can be simulated. The reserved original data is displayed in fade color and the new data is in bright color.

Press the **Acquire** button; select **Wave Display** in the bottom menu, select **Persist Time** in the right menu. Turn the **G** knob to select different persist time, including **OFF**, **100ms**~**10s** and **Infinity**. When the "**Infinity**" option is set for Persist Time, the measuring points will be stored till the controlling value is changed.

Select **Persistence OFF** to turn off persistence and clear the display.

Select **Clear** to erase the results of previous acquisitions from the display. The oscilloscope will start to accumulate acquisitions again.

► **XY Mode**

XY Mode is used to display the amplitude from one waveform against the amplitude from another. The data point from the first waveform specifies the horizontal location, while the corresponding data point from the second waveform specifies the vertical location for each displayed point.

The red waveform is CH1 versus CH2; the purple waveform is CH3 versus CH4.

The oscilloscope is set in the un-triggered sample mode: the data are displayed as bright spots.

The operations of all control knobs are as follows:

- The Vertical **VOLTS/DIV** and the **VERTICAL POSITION** knobs of **CH1** are used to set the horizontal scale and position of the red waveform.
- The Vertical **VOLTS/DIV** and the **VERTICAL POSITION** knobs of **CH2** are used to set the vertical scale and position of the red waveform.
- The Vertical **VOLTS/DIV** and the **VERTICAL POSITION** knobs of **CH3** are used to set the horizontal scale and position of the **purple** waveform.
- The Vertical **VOLTS/DIV** and the **VERTICAL POSITION** knobs of **CH4** are used to set the vertical scale and position of the **purple** waveform.

NOTE: If one of the paired channels is on, the other is off, after entering the XY mode, the closed channel will be turned on automatically.

In the XY mode, if you turn off a channel, the other channel that pair with it will be turned off automatically.

When the XY Mode is turned on, the reference waveform that has been displayed will be removed from the display automatically.

Operation steps:

1. Press the **Acquire** button.
2. Select **XY Mode** as **ON** or **OFF** in the bottom menu.

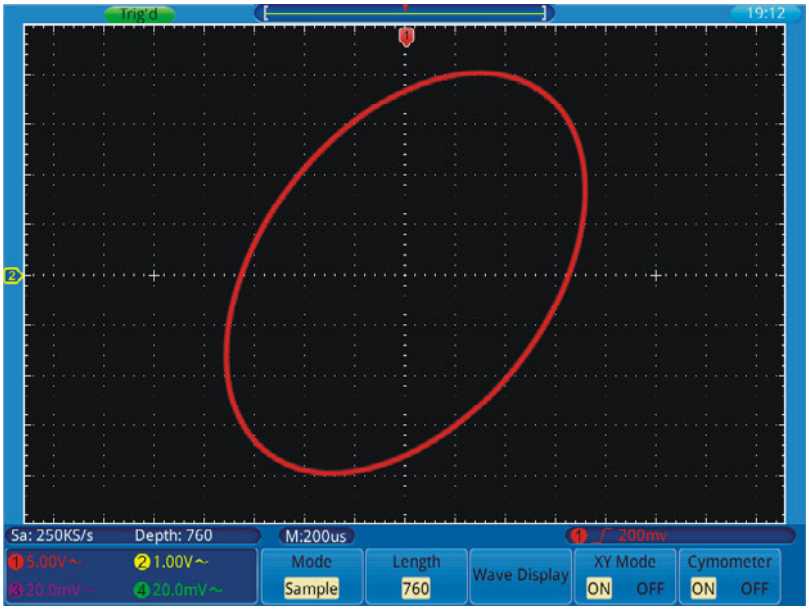


Figure 26. XY Display Mode.

► **Cymometer**

It is a 6-digit cymometer. The cymometer can measure frequencies from 2Hz to the full bandwidth. Only if the measured channel has triggering signal and in Edge mode, it can measure frequency correctly. It is a one channel cymometer and it can only measure the frequency of the triggering channel. The cymometer is displayed at the right bottom of the screen.

To turn the cymometer on or off:

1. Press the **Acquire** button.
2. Select **Cymometer** as **ON** or **OFF** in the bottom menu.

3.5.3 How to Save and Recall

Oscilloscope screen images can be saved to internal/external storage in JPG, BMP or PNG formats.

Acquired waveform data can be saved to one of 4 reference waveforms or to internal/external storage in CSV or BIN formats.

Oscilloscope setups files can be saved to one of 15 internal locations or to internal/external storage in SET format.

3.5.3.1 To save the current screen image

The screen image can be saved to internal/external storage in JPG, BMP or PNG formats.

1. Press the **Save** button.
2. Select **Save** in the bottom menu; select **Save Image** to display the file explorer.
3. Select the save location, see "To select the path or file in file explorer".
4. In the right menu, select **File format** repeatedly to switch between .jpg/.bmp/.png.
5. The path and file name are shown in the **Save To**: line in the bottom. If you want to customize the file name, select **Edit file name** in the right menu, see "To edit file names".
6. Select **OK Save** in the right menu.

You can also save the image by just pressing the Copy button, see "To save with Copy button push".

3.5.3.2 To save waveform data to reference waveform / storage

Waveform data consists of the numeric values for each point in the waveform. The waveform data of a channel or a reference waveform can be saved to one of 4 reference waveforms or to internal/external storage. To save the current waveform data:

1. Press the **Save** button.
2. Select **Save** in the bottom menu; select **Save Waveform**.
3. Select **Source** in the right menu; in the left menu, select an opened channel or a previously stored reference waveform.
4. Select **Destination** in the right menu; in the left menu, select one of 4 reference waveforms R1~R4, or select **File** to save to internal/external storage.
5. Select **Cut** in the right menu repeatedly to switch between **Screen data** or **All data**.
6. If the **Destination** is reference waveform, skip this step. If it is **File**, you can select **File detail** to enter the file explorer. The path and file name are shown in the Save To: line in the bottom. Select the save location, see "To select the path or file in file explorer" on P43. In the right menu, select **File format** repeatedly to switch between .csv/.bin. If you want to customize the file name, select **Edit file name** in the right menu, see "To edit file names" on P43. Select **OK Save** in the right menu.
7. Select **OK Save** in the right menu.

You can also save the waveform data by just pressing the Copy button, see "To save with Copy button push" on P44.

You can also save the reference waveform to storage in Ref menu, see "To display/remove reference waveforms".

3.5.3.3 To save setup files

Setup information includes acquisition information, such as vertical, horizontal, trigger, cursor, and measurement information etc. Setup files can be saved to one of 15 internal locations or to internal/external storage. To save the setup information:

1. Press the **Save** button.
2. Select **Save** in the bottom menu; select **Save Setup**.
3. Select **Destination** in the right menu; in the left menu, select one of 15 internal locations, or select **File** to save to internal/external storage.
4. If the **Destination** is Set1~Set15, skip this step. If it is **File**, you can select **File detail** to enter the file explorer. The path and file name are shown in the **Save To**: line in the bottom. Select the save location, see "To select the path or file in file explorer". If you want to customize the file name, select **Edit file name** in the right menu, see "To edit file names". Select **OK Save** in the right menu.
5. Select **OK Save** in the right menu.

You can also save setup files by just pressing the **Copy** button, see "To save with Copy button push".

3.5.3.4 To display/remove reference waveforms

1. Press the **Save** button.
2. Select **Ref** in the bottom menu.
3. For R1~R4, switch to **ON**, the reference waveform will be displayed; switch to **OFF**, the reference waveform will be removed. You can display multiple reference waveforms at the same time.
4. When the reference waveform is **ON**, you can select **Vertical** in the right menu; select repeatedly to make the G symbol in front of div, turn the G knob to adjust the vertical position; then select to make the G symbol in front of the **V/div** below, turn the **G** knob to adjust the voltage division. Select **Horizontal** in the right menu; do the same operations as above to set the horizontal position and time base.
5. Select **Ref detail** in the right menu, a window will pop up to show the sample rate and sample length.
6. Select **Save to file** in the right menu to save current reference waveform to internal/external storage. See the step 6 of "To save waveform data to reference waveform/storage".

3.5.3.5 To recall waveform data in storage

1. Press the **Save** button.
2. Select **Recall** in the bottom menu; select **Recall Waveform**.
3. Select the waveform file in file explorer (*.csv/*.bin), see "To select the path or file in file explorer".
4. Select the reference waveform that you want to load to in the right menu.
5. Operate the selected reference waveform, see "To display/remove reference waveforms".

3.5.3.6 To recall setup files

Setup files can be recalled from one of 15 internal locations or from internal/external storage.

1. Press the **Save** button.
2. Select **Recall** in the bottom menu; select **Recall Setup**.
3. Select **From** in the right menu; in the left menu, select one of 15 internal locations, or select **File** to recall from internal/external storage.
4. If you select one from Set1~Set15, select **OK Load** in the right menu.
5. If you select **File**, select **File detail** to enter the file explorer. Select the setup file in file explorer (*.set), see "To select the path or file in file explorer". Select **Recover Setup** in the right menu.

3.5.3.7 To select the path or file in file explorer

Introduction of the drive letters

D: Internal storage.

E/F etc.: The USB flash drive plugged into the USB port of the oscilloscope. In file explorer, you can use touchscreen or the G knob to select the storage, folder or file.

Using touchscreen: You can drag your finger up or down to scroll the file list; touch the drive letter, folder or file to select. Touch the drive letter or folder twice quickly to expand or collapse the file list.

Using the G knob: Turn the G knob to select in the file list. When the drive letter or folder is selected, push the G knob to expand or collapse the file list.

3.5.3.8 To edit file names

The oscilloscope gives all files it creates a default name in the following format:

- ► XXXX.set for setup files.
- ► XXXX.png, XXXX.bmp, or XXXX.jpg for image files.
- ► XXXXYYY.csv or XXXXYYY.bin for waveform files.
- ► XXXX.PF for rule files of pass/fail.

The XXXX is an integer from 0000 to 9999.

For waveform files, the YYY is the channel of the waveform, and can be one of the following: CH1, CH2, CH3, or CH4 for the channels; RF1, RF2, RF3, or RF4 for reference waveforms

When entering the interface of editing name, there will be a keypad dialog that let you touch to enter names. The length of file name is up to 256 characters. When you are done entering the file name, touch the dialog's Enter to confirm and close the keypad dialog.

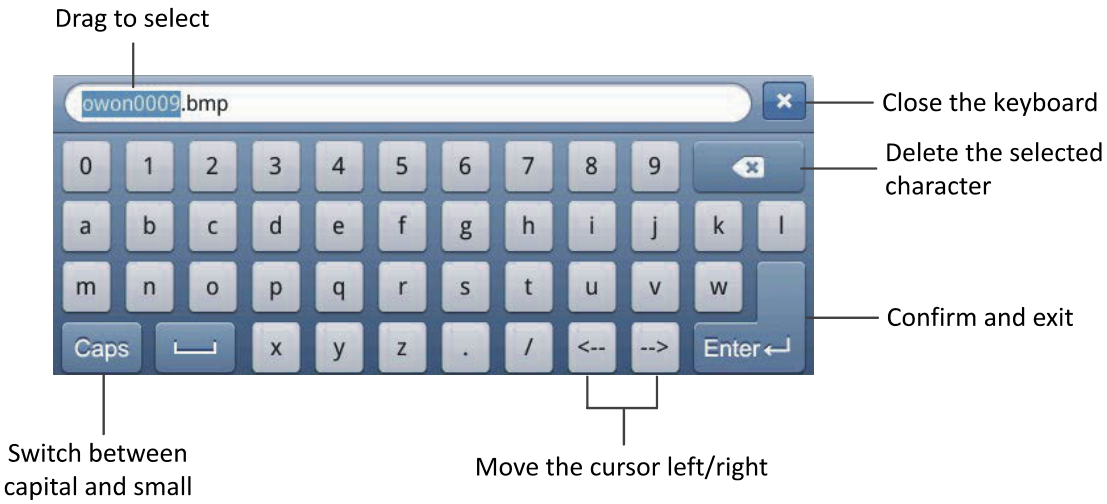

Drag to select
owon0009.bmp
Close the keyboard
Delete the selected character
Confirm and exit
Switch between capital and small
Move the cursor left/right
0 1 2 3 4 5 6 7 8 9
a b c d e f g h i j k l
m n o p q r s t u v w
Caps x y z . / <-- --> Enter

Figure 27.

3.5.3.9 To save with Copy button push

You can save the image, waveform data or setup file by just pressing the Copy button.

After you have defined the save parameters with the Save menu, you can save files with a single push of the Copy button. For example, if you have defined the save operation to save image to external storage, then each push of the Copy button will save current screen image to the defined external storage.

To define the Copy button behavior, follow the steps below.

1. Press the **Save** button.
2. Select **Save to Config** in the bottom menu.
3. Select the save type from **Screen Image**, **Waveform** and **Setup**.
4. Select **Change folder** to define the save path, see "To select the path or file in file explorer".

When you push the **Copy** button, the oscilloscope will perform the action that you just specified rather than requiring you to enter the Save menu each time.

3.5.3.10 To manage file

You can create folder, rename or delete a file in File utilities menu.

1. Press the **Save** button.
2. Select **File utilities** in the bottom menu.
3. Select path or file in file explorer, see "To select the path or file in file explorer".
4. Select **Create folder**, **Rename** or **Delete** in the right menu. See "To edit file names".

3.5.4 How to Implement the Auxiliary System Function Setting

► **Config**

- **To change the user interface language**

1. Press the **Utility** button, select **Config** in the left menu.
2. Select **Language** in the bottom menu; select the desired language in the right menu.

- **To set the network parameters**

Using the LAN port, the oscilloscope can be connected with a computer directly, or through the router to connect. The network parameters can be set in Net Config dialog. Refer to "Using LAN Port" on P60 for the operation steps.

1. Press the **Utility** button, select **Config** in the left menu.
2. Select **Net Config** in the bottom menu; the IP Config dialog will pop up.
3. Touch the byte to show the cursor, you can drag to select the numbers. Select the number keys below in the dialog to change the value, the range of each byte is 0 ~ 255. The range of Port is 0 ~ 65535. Touch to delete current byte. Touch to complete the setting.

- **To change the date and time**

1. Press the **Utility** button, select **Config** in the left menu.
2. Select **Time Config** in the bottom menu; the Time Setting dialog will pop up.
3. Touch the value that needs to be changed, a cursor will appear. You can drag to select the numbers. Turn the **G** knob to change the selected value. Touch **OK** to complete the setting.

- **To enable/disable VGA output**

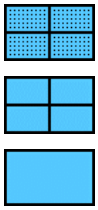
The VGA port could be connected to a computer monitor. The image of the oscilloscope can be clearly displayed on the monitor.

1. Press the **Utility** button, select **Config** in the left menu.
2. Select **VGA** as **ON** or **OFF** in the bottom menu.

► **Display**

Press the **Utility** button and select the **Display** in the left menu.

The description of **Display Menu** is shown as the follows:

Function Menu	Setting	Description
BackLight	0%~99%	Drag the slider or turn the G knob to adjust the backlight.
Graticule		Select the grid type.
Menu Display	5s~50s, Infinite	Set the disappear time of left and right menu.
Gesture	ON, OFF	Enable/disable the touchscreen controls.

► **Calibrate**

Press the **Utility** button and select **Calibrate** in the left menu.

The description of **Calibrate menu** is shown as the follows:

Function Menu	Description
Self Calibrate	Carry out the self-calibration procedure.
Factory Set	Call out the factory settings.
Touch Screen Calibrate	Touchscreen accuracy calibration

- **Do Self-Calibration**

  The self-calibration procedure can improve the accuracy of the oscilloscope under the ambient temperature to the greatest extent. If the change of the ambient temperature is up to or exceeds 5 °C, the self-calibration procedure should be executed to obtain the highest level of accuracy.

  Before performing a self-calibration, disconnect all probes or wires from the input connector. Press the "**Utility**" button, select **Calibrate** in the left menu, select **Self Calibrate** in the bottom menu. A confirmation window will pop up, select **OK** after everything is ready.

► Pass/Fail

The **Pass/Fail** function monitors changes of signals and output pass or fail signals by comparing the input signal that is within the pre-defined mask.

Press the **Utility** button and select the **Pass/fail** in the left menu.

The description of **Pass/Fail Menu** is shown as the follows:

Function Menu	Setting	Description
Operator	Enable	Control enable switch.
	Operate	Control operate switch.
Output	Pass	Signal tested corresponds with the rule.
	Fail	Signal tested not correspond with the rule.
	Ring	Ring when it satisfies the rule.
	Info	Control the display status of info frame.
Rule	Source	Select source ①, ②, ③, ④ or Math.
	Horizontal	Change the Horizontal tolerance value by turning the **G** knob.
	Vertical	Change the Vertical tolerance value by turning the **G** knob.
	Create	Use the rule set as testing rule.
Save Rule	Save	Save the rule to internal/external storage.
	Recall	Recall a rule from internal/external storage as the testing rule.

- **Pass/Fail test:**

  Detect whether the input signal is within the limits of the rule, if it exceeds limits of the rule, it is "Fail"; otherwise it is "Pass". Also it can output fail or pass signal by built-in and configurable output port. To run the test, read the following steps:

1. Press the **Utility** button, select **Pass/Fail** in the left menu.
2. **Enable switch on**: select **Operator** in the bottom menu, set **Enable** as **ON** in the right menu.
3. **Create rule**: select **Rule** in the bottom menu. Select **Source** in the right menu; select the desired source in the left menu. Select **Horizontal** or **Vertical** in the right menu; turn the **G** knob to set Horizontal or Vertical tolerance. Select **Create** in the right menu.
4. **Set output type**: Select **Output** in the bottom menu. Choose any one or two of the options "**Pass**", "**Fail**" or "**Ring**". "**Pass**" and "**Fail**" are mutually exclusive options, which could not be chosen simultaneously.
5. **Begin to test:** Select **Operator** in the bottom menu. Select **Operator** as **Start** in the right menu, the test will begin.
6. **Save rule:** Select **Save rule** in the bottom menu. Select **Save** in the right menu to enter file explorer. The path and file name are shown in the **Save To**: line in the bottom. Select the save location, see "To select the path or file in file explorer". If you want to customize the file name, select **Edit Filename** in the right menu, see "To edit file names". Select **OK Save** in the right menu.

7 Recall rule: Select **Save rule** in the bottom menu. Select **Recall** in the right menu to enter file explorer. Select rule file(*.PF), see "To select the path or file in file explorer". Select the channel that you want to load to in the right menu.

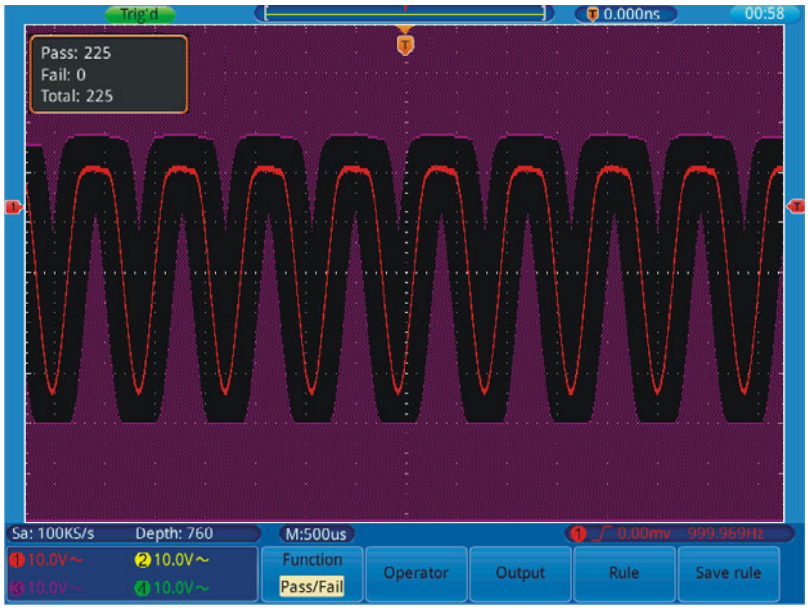


Figure 28. Pass/Fail test

NOTE:

1 When Pass/Fail is ON, if you enter XY mode, Pass/Fail will be closed; in the XY mode, Pass/Fail menu is disabled.

2 Under the status of stop, data comparing will stop, and when it goes on running, the number of Pass/Fail will increase from the former number, not from zero.

► **Sync Output**

Press the **Utility** button and select **Sync Output** in the left menu.

The description of **Sync Output** menu is shown as the follows:

Function Menu	Setting	Description
Type	Trig level	Output trig signal synchronously.
	Pass/fail	Output High Level when Pass , and Low Level when Fail.

► **System**

Press the **Utility** button and select **System** in the left menu.

The description of **System** menu is shown as the follows:

Function Menu	Description
Help	Select a topic in Help catalog to view the help content. To exit the Help window, touch in the top right corner or just press the panel buttons.
About	Show the series number and version.
Update	Place the software upgrade in the root of the U disk.

3.5.5 How to Measure Automatically

Press the **Measure** button to display the menu for the settings of the Automatic Measurements.

The oscilloscopes provide 22 parameters for auto measurement, including Period, Freq, Mean, PK-PK, RMS, Max, Min, Vtop, Vbase, Vamp, Overshoot, Preshoot, Rise Time, Fall Time, +Width, -Width, +Duty, -Duty, Delay 1→2, Delay 1→2, Delay 3→4, Delay 3→4.

The "Automatic Measurements" menu is described as the following table:

Function Menu		Setting	Description
Add	Type		Select type in the left menu.
	Source	① ② ③ ④	Select the source.
	Show all		Show all the measures on the screen.
	Add		Add the selected measure types (shown at the left bottom, you could only add 8 types at most).
Remove	Type		Remove all the measures.
	Delete all		Delete all the measures.
	Delete		Delete the chosen measure type.

► **Measure**

Only if the waveform channel is in the ON state, the measurement can be performed. The automatic measurement cannot be performed in the following situation: 1) On the reference waveform. 2) On the Math waveform. 3) On the XY format. 4) On the Scan format.

Measure the frequency, the period of the Channel CH1 and the mean, the PK-PK of the Channel CH2, following below steps:

1. Press the **Measure** button.
2. Select **Add** in the bottom menu.
3. Select **Source** in the right menu; select ① in the left menu.
4. Select **Type** in the right menu; select **Period** in the left menu.
5. Select **Add** in the right menu, the period options added completes.
6. Select **Freq** in the left menu.
7. Select **Add** in the right menu, the frequency added completes, finish setting of CH1.
8. Select **Source** in the right menu; select ② in the left menu.
9. Select **Type** in the right menu; select **Mean** in the left menu.
10. Select **Add** in the right menu, the Mean added completes.
11. Select **PK-PK** in the left menu.

12 Select **Add** in the right menu, the PK-PK added completes, finish setting of CH2.

The measured value will be displayed at the bottom left of the screen automatically (see Figure 29).

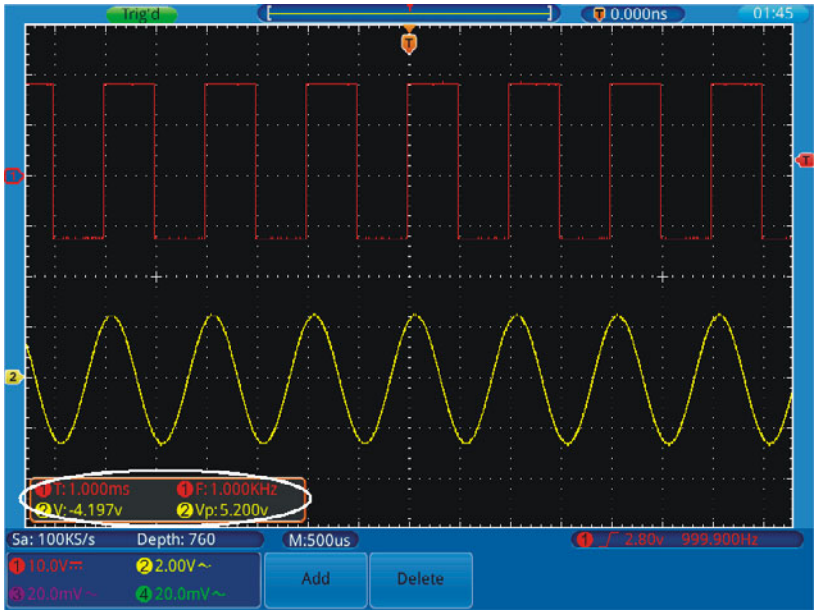


Figure 29. Automatic measurement.

3.5.5.1 The automatic measurement of voltage parameters

The **OD-624** oscilloscope provide time parameters auto-measurements include Frequency, Period, Rise Time, Fall Time, +Width, -Width, +Duty, -Duty, Delay 1→2, Delay 1→2, Delay 3→4, Delay 3→4.

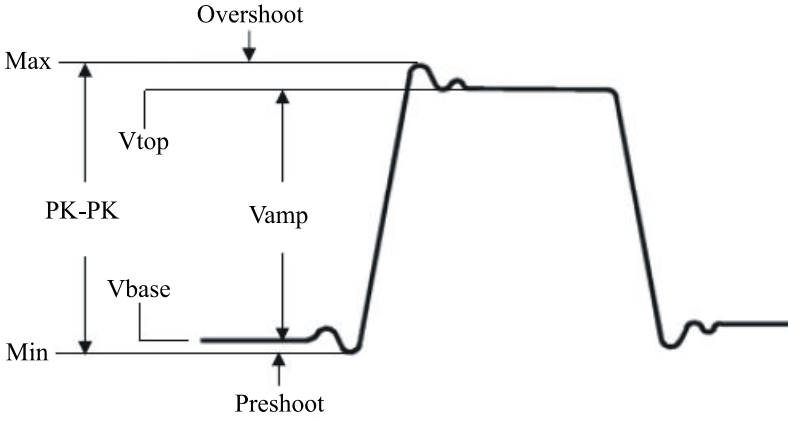


Figure 30.

- **PK-PK:** Peak-to-Peak Voltage.
- **Max:** The maximum amplitude. The most positive peak voltage measured over the entire waveform.
- **Min:** The minimum amplitude. The most negative peak voltage measured over the entire waveform.
- **Vamp:** Voltage between Vtop and Vbase of a waveform.
- **Vtop:** Voltage of the waveform's flat top, useful for square/pulse waveforms.
- **Vbase:** Voltage of the waveform's flat base, useful for square/pulse waveforms.
- **Overshoot:** Defined as (Max-Vtop)/Vamp, useful for square and pulse waveforms.
- **Preshoot:** Defined as (Min-Vbase)/Vamp, useful for square and pulse waveforms.
- **Mean:** The arithmetic mean over the entire waveform.
- **RMS:** The true Root Mean Square voltage over the entire waveform.

3.5.5.2 The automatic measurement of time parameters

The **OD-624** oscilloscope provide time parameters auto-measurements include Frequency, Period, Rise Time, Fall Time, +Width, -Width, +Duty, -Duty, Delay 1→2, Delay 1→2, Delay 3→4, Delay 3→4.

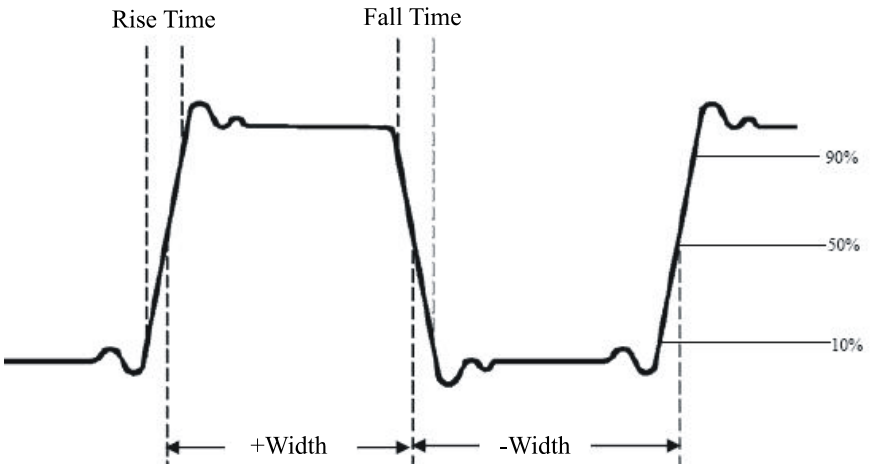


Figure 31. Shows a pulse with some of the time measurement points.

- **Rise Time:** Time that the leading edge of the first pulse in the waveform takes to rise from 10% to 90% of its amplitude.
- **Fall Time:** Time that the falling edge of the first pulse in the waveform takes to fall from 90% to 10% of its amplitude.
- **+Width:** The width of the first positive pulse in 50% amplitude points.
- **-Width:** The width of the first negative pulse in the 50% amplitude points.
- **Delay** ①→② **and Delay** ①→②: The delay between the two channels at the rising edge.
- **Delay** ③→④ **and Delay** ③→④: The delay between the two channels at the falling edge.
- **+Duty**: +Duty Cycle, defined as +Width/Period.
- **-Duty**: -Duty Cycle, defined as -Width/Period.

3.5.6 How to Measure with Cursors

Press the **Cursor** button to display the cursor measurement function menu in the bottom menu. If there is already a cursor measure window at the top right, you can touch it to display the Cursor Measure Menu too.

3.5.6.1 The Cursor Measurement for normal mode

The cursor measurement includes **Voltage Measurement** and **Time Measurement** at normal mode.

The description of the **cursor measurement menu** is shown as the following table:

Function Menu	Setting	Description
Type	OFF	Turn off the cursor measurement.
	Voltage	Measure voltage using cursor.
	Time	Measure time using cursor.
Source	① / ② / ③ / ④ / Ⓜ	Select the source that the cursor measurement will be applied to.

Function Menu	Setting	Description
Line	L1	Turn the **G** knob to adjust the position of L1.
	L2	Turn the **G** knob to adjust the position of L2.
	L1&L2	Two cursors are linked. Turn the **G** knob to adjust the two cursors together.

Perform the steps below for the voltage cursor measurement of the channel CH1:

1. Press the **Cursor** button.
2. Select **Source** in the bottom menu; select ① in the left menu.
3. Select **Type** in the bottom menu; select **Voltage** in the right menu. Two red dotted lines displayed along the horizontal direction of the screen, which indicating L1 and L2.
4. Select **Line** in the bottom menu; select **L1** in the right menu. The G icon will appear beside the dotted line of L1, represents you can turn the **G** knob to adjust the position of L1. Select **L2** to adjust the position of L2. Select **L1&L2** to adjust the two cursors together. The cursor measure window at the top right shows the present position of two cursors and the absolute value of voltage difference (see Figure 32).

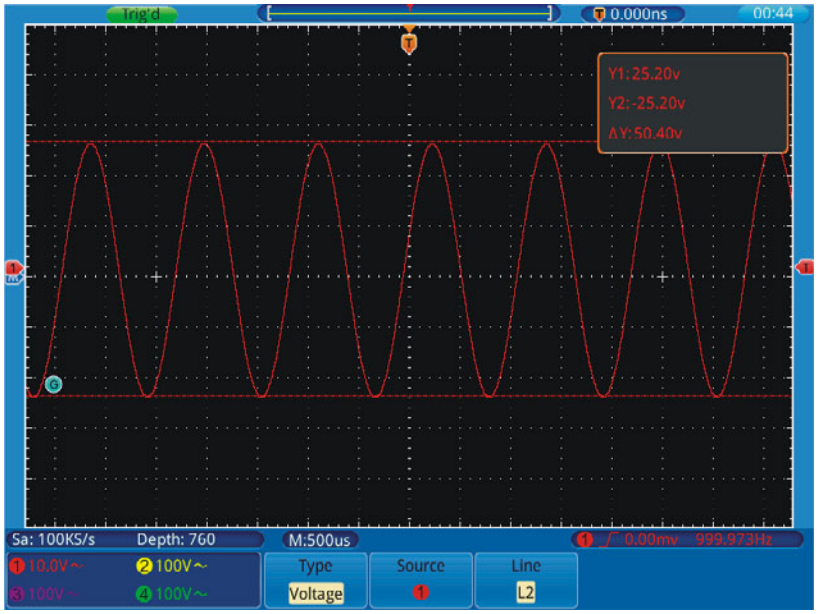


Figure 32. Waveform of Voltage Cursor Measurement.

Carry out the steps below for the time cursor measurement of the channel CH1:

1. Press the **Cursor** button.
2. Select **Source** in the bottom menu; select ① in the left menu.
3. Select **Type** in the bottom menu; select **Time** in the right menu. Two red dotted lines displayed along the vertical direction of the screen, which indicating L1 and L2.
4. Select **Line** in the bottom menu; select **L1** in the right menu. The G icon will appear beside the dotted line of L1, represents you can turn the **G** knob to adjust the position of L1. Select **L2** to adjust the position of L2. Select **L1&L2** to adjust the two cursors together. The cursor measure window at the top right shows the present time of cursor 1 and cursor 2, the absolute difference and the frequency (see Figure 33).

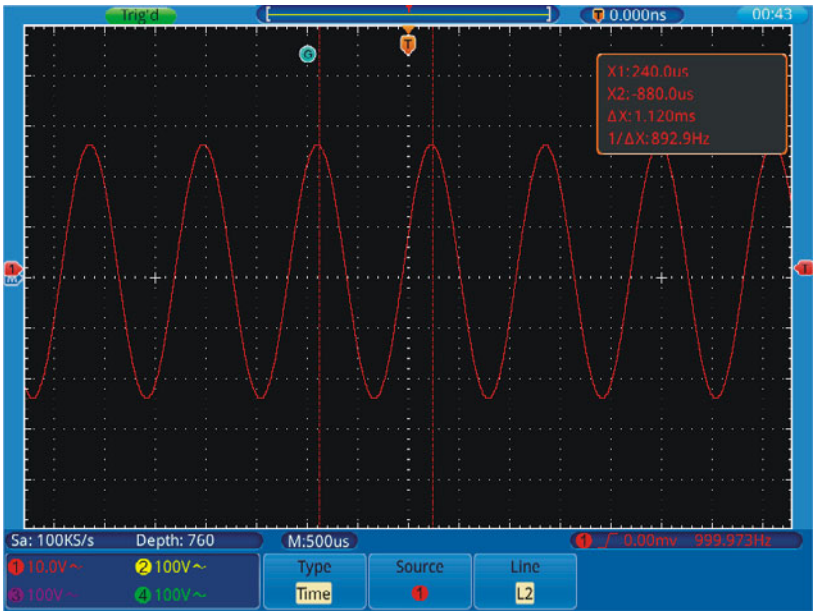


Figure 33. Waveform of Time Cursor Measurement.

3.5.6.2 The Cursor Measurement for FFT mode:

Perform the steps below for the Vamp cursor measurement in FFT mode:

1. Press the **Cursor** button.
2. Select **Source** in the bottom menu; select Ⓜ in the left menu.
3. Select **Type** in the bottom menu; select **Vamp** in the right menu. Two blue dotted lines displayed along the horizontal direction of the screen, which indicating L1 and L2.
4. Select **Line** in the bottom menu; select **L1** in the right menu. The G icon will appear beside the dotted line of L1, represents you can turn the **G** knob to adjust the position of L1. Select **L2** to adjust the position of L2. Select **L1&L2** to adjust the two cursors together. The cursor measure window at the top right shows the present position of two cursors and the absolute value of amplitude difference (see Figure 34).

Figure 34. Wave of Vamp cursor measurement.

Carry out the steps below for the Frequency cursor measurement:

1. Press the **Cursor** button.
2. Select **Source** in the bottom menu; select Ⓜ in the left menu.
3. Select **Type** in the bottom menu; select **Frequency** in the right menu. Two blue dotted lines displayed along the vertical direction of the screen, which indicating L1 and L2.
4. Select **Line** in the bottom menu; select **L1** in the right menu. The G icon will appear beside the dotted line of L1, represents you can turn the **G** knob to adjust the position of L1. Select **L2** to adjust the position of L2. Select **L1&L2** to adjust the two cursors together. The cursor measure window at the top right shows the present position of two cursors and the absolute value of frequency difference (see Figure 35).

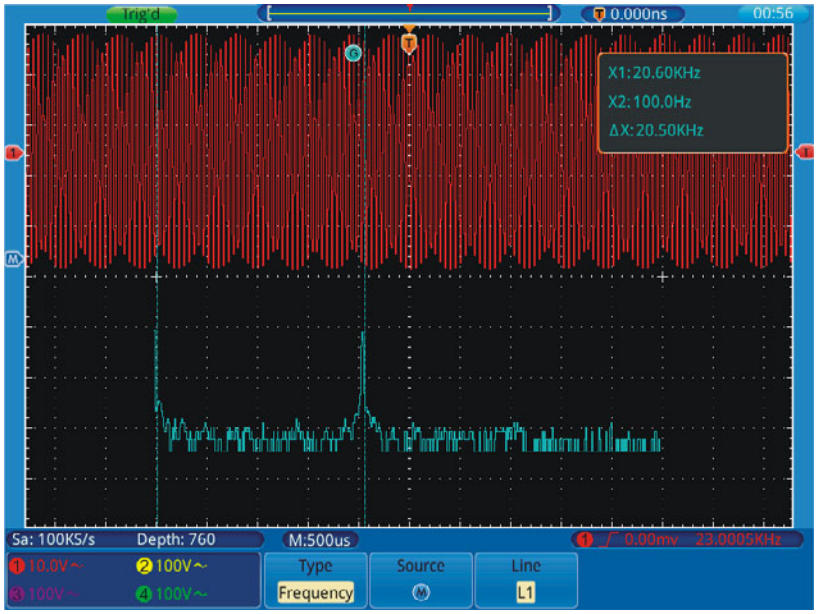
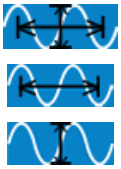
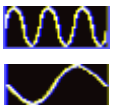


Figure 35. Wave of Freq cursor measurement.

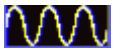
3.5.7 How to Use Autoscale

This is a very useful function for first time users to carry out a simple and quick test on the input signal. The function is applied to follow-up signals automatically even if the signals change at any time. Autoscale enables the instrument to set up trigger mode, voltage division and time scale automatically according to the type, amplitude and frequency of the signals. Press the **Autoscale** button to display the function menu in the bottom.

The menu is as follows:

Function Menu	Setting	Instruction
Autoscale	ON OFF	Turn on Autoscale. Turn off Autoscale.
Mode		Follow-up and adjust both vertical and horizontal settings. Follow-up and only adjust horizontal scale. Follow-up and only adjust vertical scale.
Wave Period		Show Multi-period waveforms. Only show one or two periods.

If you want to measure the signal, you can do as the follows:

1. Press **Autoscale** button, the function menu will appear in the bottom.
2. Select **AutoScale** as **ON**.
3. Select **Mode** in the bottom menu, select in the right menu.
4. Select **Wave Period** in the bottom menu, select  in the right menu, shown as Figure 36.

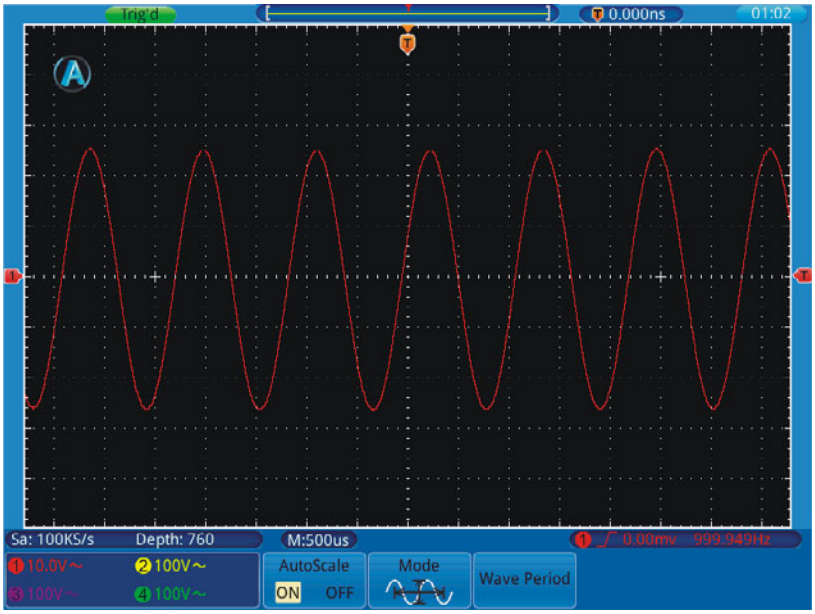


Figure 36. Autoscale Horizontal-Vertical multi-period waveforms.

NOTE:

1. When entering into Autoscale mode, the symbol will appear on the top left of the screen.
2. In the Autoscale mode, the oscilloscope can self-estimate "Trigger Mode" (Edge, Video), and set coupling as DC, trigger mode as Auto. The TRIGGER Menu is not available.
3. In the mode of XY and STOP status, when entering into Autoscale, TDS will switch to YT mode and AUTO triggering.
4. In the Autoscale mode, if you adjust the vertical position, voltage division, trigger level or time scale of CH1 ~ CH4, the oscilloscope will turn off Autoscale function.
5. While the Autoscale is working, settings below will be made forcibly:
   - If it is in zoom mode previously, the zoom mode will be turned off.
   - The acquire mode will be set as **Sample**.

3.5.8 How to Use Executive Buttons

Executive Buttons include **Autoset, Run/Stop, Single, Copy**.

► **Autoset**

It's a very useful and quick way to apply a set of pre-set functions to the incoming signal, and display the best possible viewing waveform of the signal and also works out some measurements for user as well.

The details of functions applied to the signal when using **Autoset** are shown as the following table:

Function Items	Setting
Acquisition Mode	Current
Vertical Coupling	DC
Vertical Scale	Adjust to the proper division.
Bandwidth	Full
Horizontal Level	Middle
Horizontal Sale	Adjust to the proper division
Trigger Type	Adjust to the proper type
Trigger Source	Show the minimum number of channels.
Trigger Coupling	DC
Trigger Slope	Current
Trigger Level	Mid-point Setting
Trigger Mode	Auto
Display Format	YT

► **Run / Stop**

Enable or disable sampling on input signals.

Notice: When there is no sampling at STOP state, the vertical division and the horizontal time base of the waveform still can be adjusted within a certain range, in other words, the signal can be expanded in the horizontal or vertical direction.

► **Single**

Press this button you can set the trigger mode as single directly, so when trigger occurs, acquire one waveform then stop.

► **Copy**

You can save the image, waveform data or setup file by just pressing the Copy button. After you have defined the save parameters with the Save menu, you can save files with a single push of the Copy button. For more details, please see "To save with Copy button push".

4 COMMUNICATION WITH PC

The **OD-624** oscilloscope support communications with a PC through USB or LAN port. You can use the communication software to store, analyze and display the data.

Here is how to connect with PC. First, install the communication software on the supplied CD. Then there are several ways of connection to choose from.

4.1 Using USB Port

1. **Connection**: Use a USB data cable to connect the **USB Device port** in the rear panel of the Oscilloscope to the USB port of a PC.
2. **Install the driver**: Run the communication software on PC, press F1 to open the help document. Follow the steps of title "**I. Device connection**" in the document to install the driver.
3. **Port setting of the software**: Run the software; click "Communications" in the menu bar, choose "Ports-Settings", in the setting dialog, choose "Connect using" as "USB".

   After connect successfully, the connection information in the bottom right corner of the software will turn green.

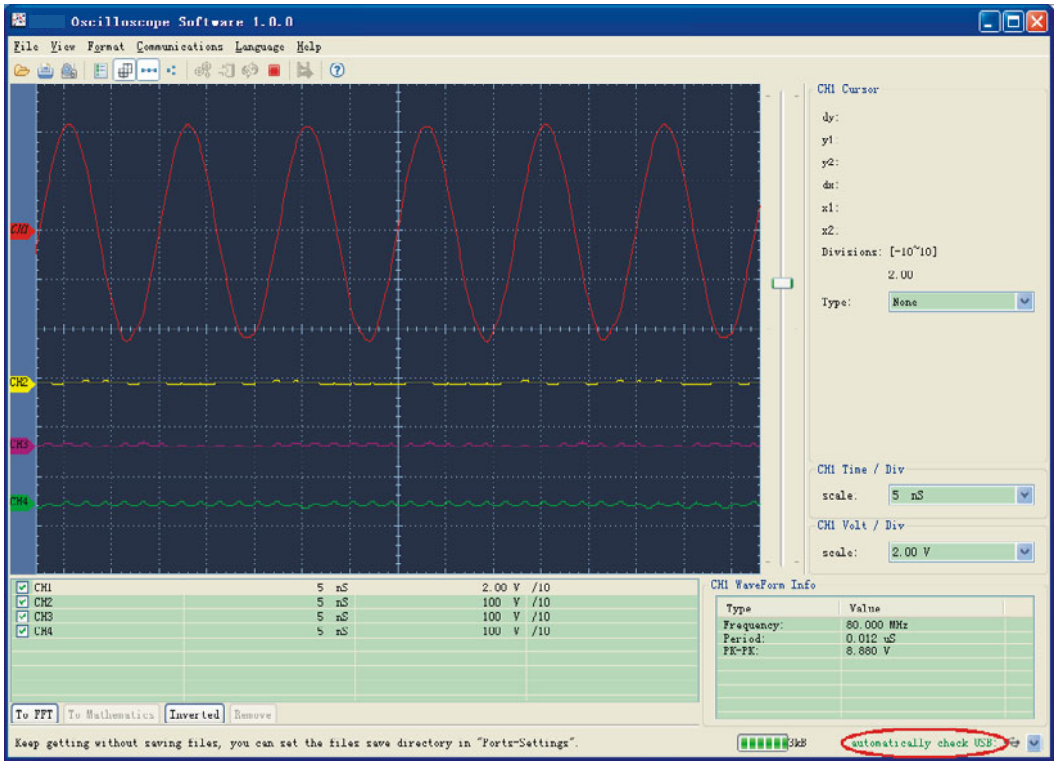


Figure 37. Connect with PC through USB port.

4.2 Using LAN Port

► Connect directly

1. **Connection**. Plug in the LAN line to the LAN port in the rear panel of the oscilloscope; plug the other end into the LAN interface of the computer.

2. **Set the network parameters of the computer**. Since the oscilloscope cannot support obtaining an IP address automatically, you should assign a static IP address. Here we set the IP address to 192.168.1.71.

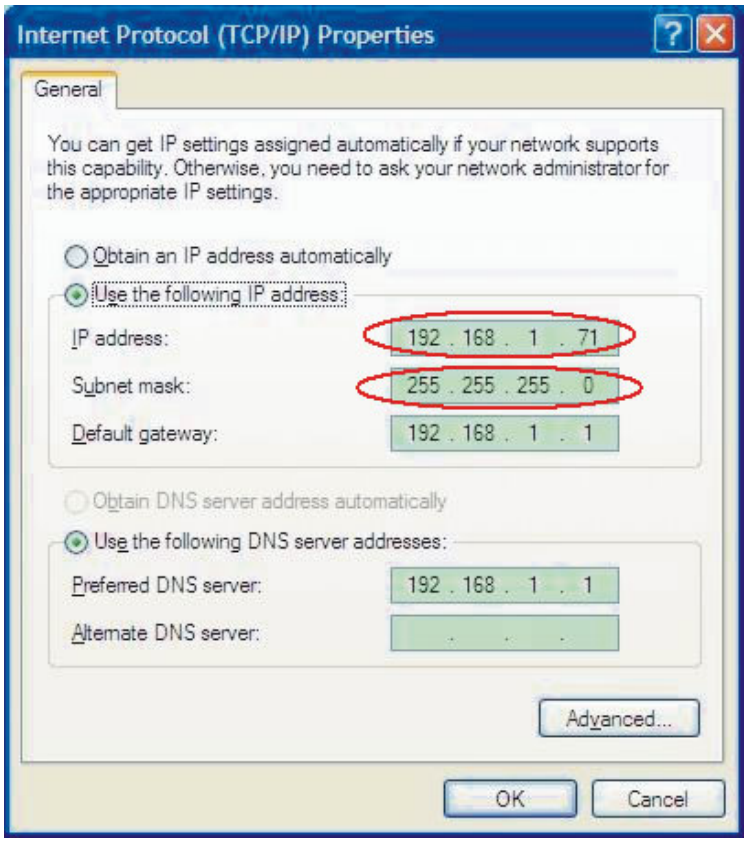

Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address: 192 . 168 . 1 . 71
Subnet mask: 255 . 255 . 255 . 0
Default gateway: 192 . 168 . 1 . 1
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server: 192 . 168 . 1 . 1
Alternate DNS server:
Advanced...
OK
Cancel

Figure 38. Set the network parameters of the computer.

3. **Set the network parameters of the Software**. Run the software on the computer; choose the "Ports-settings" of the "Communications" menu item. Set "Connect using" to LAN. About the IP, the first three bytes is same as the IP in the step (2), the last byte should be different. Here, we set it to 192.168.1.72. The range of the port value is 0~65535, but the port which under 2000 is always be used, so it is suggested to set it to the value above 2000. Here, we set it to 3000.

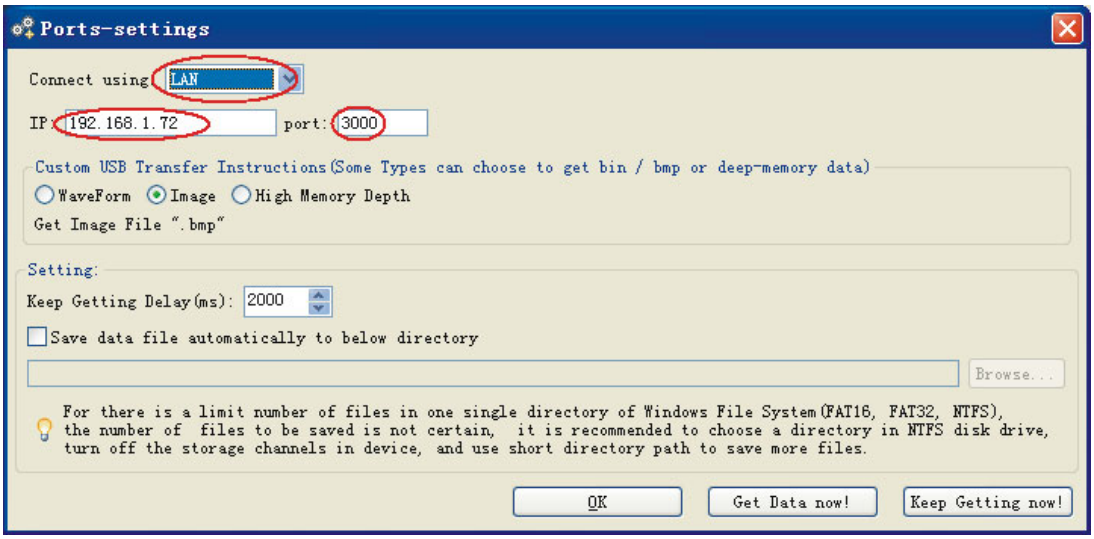

Ports-settings
Connect using LAN
IP: 192.168.1.72
port: 3000
Custom USB Transfer Instructions(Some Types can choose to get bin / bmp or deep-memory data)
WaveForm
Image
High Memory Depth
Get Image File ".bmp"
Setting:
Keep Getting Delay(ms): 2000
Save data file automatically to below directory
Browse...
For there is a limit number of files in one single directory of Windows File System(FAT16, FAT32, NTFS), the number of files to be saved is not certain, it is recommended to choose a directory in NTFS disk drive, turn off the storage channels in device, and use short directory path to save more files.
OK
Get Data now!
Keep Getting now!

Figure 39. Set the network parameters of the Software.

4 **Set the network parameters of the oscilloscope**. In the oscilloscope, Press the **Utility** button, select **Config** in the left menu. Select **Net Config** in the bottom menu. Set the **IP Address** and **Port** to the same value as the "Ports-settings" in the software in step (3). You can refer to "To set the network parameters". Touch OK to complete the setting. If you can get data normally in the software, the connection is successful.

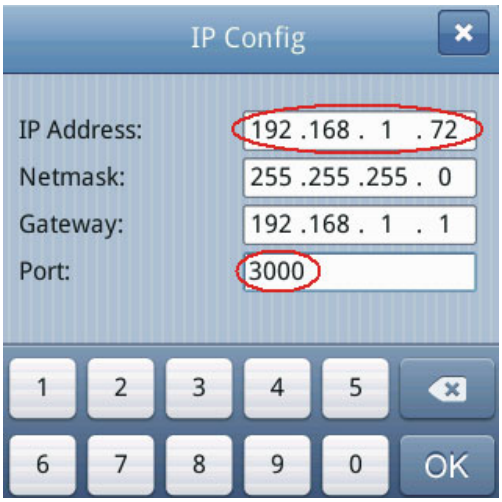


Figure 40. Set the network parameters of the oscilloscope.

4.3 Connect through a router

1. **Connection**. Use a LAN line to connect the oscilloscope with a router, the LAN port of the oscilloscope is in the rear panel; the computer should be connected to the router too.

2. **Set the network parameters of the computer**. Since the oscilloscope cannot support obtaining an IP address automatically, you should assign a static IP address. The Default gateway and Subnet mask should be set according to the router. Here we set the IP address to 192.168.1.71, Subnet mask is 255.255.255.0, Default gateway is 192.168.1.1.

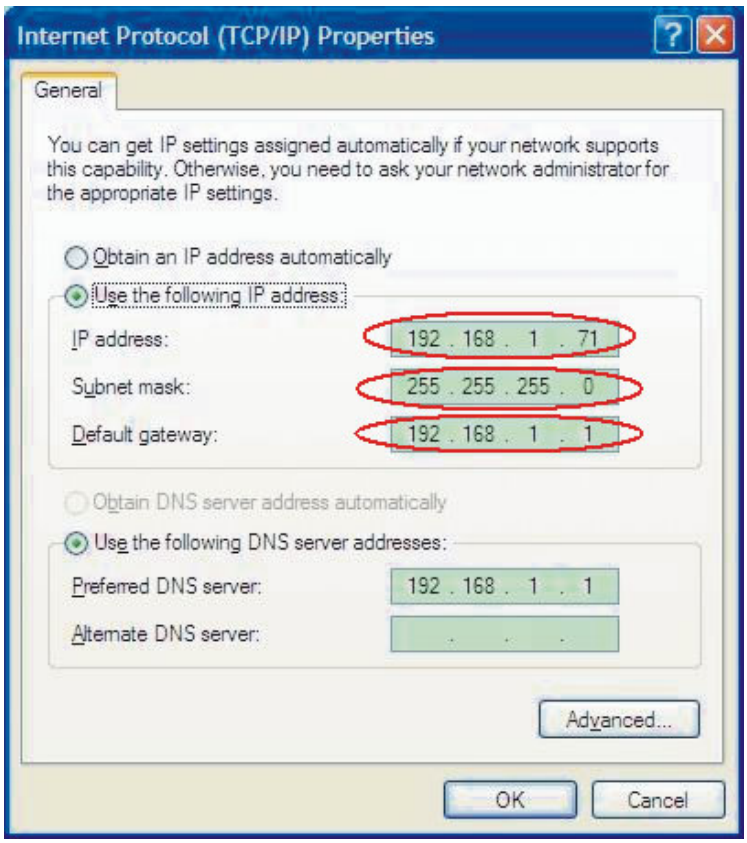

Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address: 192 . 168 . 1 . 71
Subnet mask: 255 . 255 . 255 . 0
Default gateway: 192 . 168 . 1 . 1
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server: 192 . 168 . 1 . 1
Alternate DNS server:
Advanced...
OK
Cancel

Figure 41. Set the network parameters of the computer.

3. **Set the network parameters of the Software**. Run the software on the computer; choose the "Ports-settings" of the "Communications" menu item. Set "Connect using" to LAN. About the IP, the first three bytes is same as the IP in the step (2), the last byte should be different. Here, we set it to 192.168.1.72. The range of the port value is 0~65535, but the port which under 2000 is always be used, so it is suggested to set it to the value above 2000. Here, we set it to 3000.

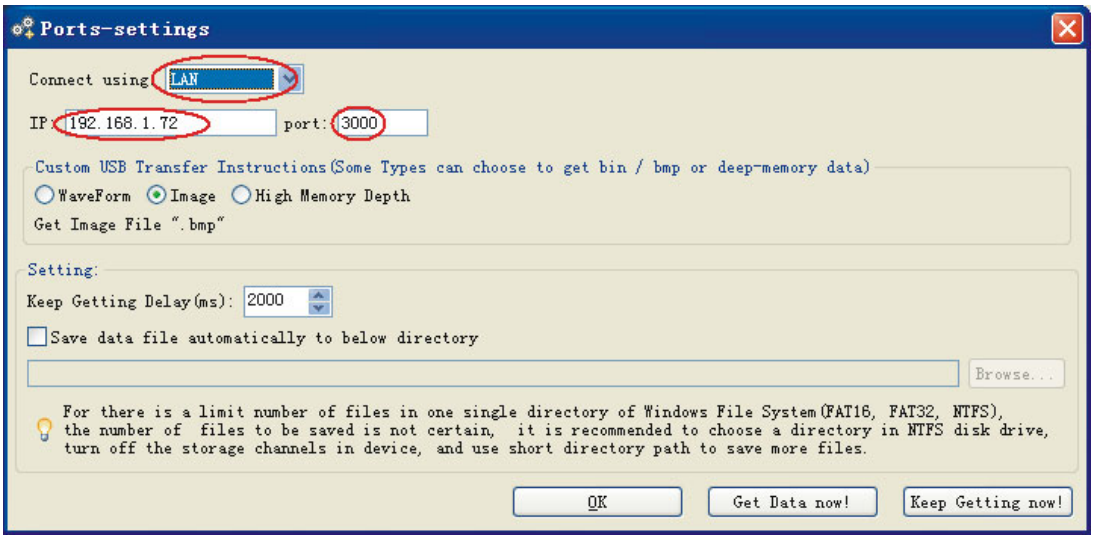

Ports-settings
Connect using LAN
IP: 192.168.1.72
port: 3000
Custom USB Transfer Instructions(Some Types can choose to get bin / bmp or deep-memory data)
WaveForm
Image
High Memory Depth
Get Image File ".bmp"
Setting:
Keep Getting Delay(ms): 2000
Save data file automatically to below directory
Browse...
For there is a limit number of files in one single directory of Windows File System(FAT16, FAT32, NTFS), the number of files to be saved is not certain, it is recommended to choose a directory in NTFS disk drive, turn off the storage channels in device, and use short directory path to save more files.
OK
Get Data now!
Keep Getting now!

Figure 42. Set the network parameters of the Software.

4 **Set the network parameters of the oscilloscope**. In the oscilloscope, Press the **Utility** button, select **Config** in the left menu. Select **Net Config** in the bottom menu. Set the **IP Address** and **Port** to the same value as the "Ports-settings" in the software in step (3). The **Netmask** and **Gateway** should be set according to the router. You can refer to "To set the network parameters". Touch OK to complete the setting. If you can get data normally in the software, the connection is successful.

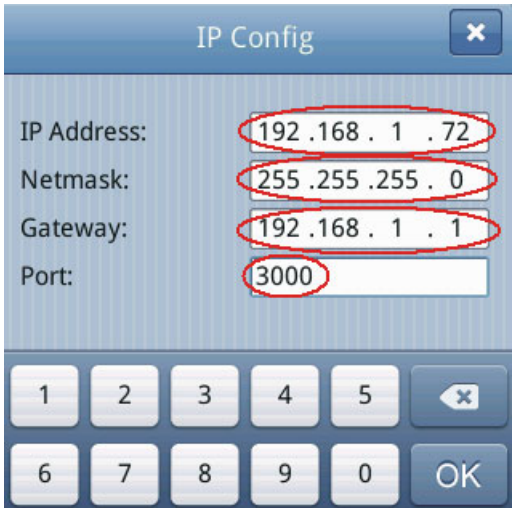


Figure 43 Set the network parameters of the oscilloscope.

To learn about how to operate the software, you can press F1 in the software to open the help document.

5 DEMONSTRATION

5.1 Example 1: Measurement a Simple Signal

The purpose of this example is to display an unknown signal in the circuit, and measure the frequency and peak-to-peak voltage of the signal.

► **Carry out the following operation steps for the rapid display of this signal:**

1. Set the probe menu attenuation coefficient as **10X** and that of the switch in the probe switch as **10X** (see "How to Set the Probe Attenuation Coefficient").
2. Connect the probe of **Channel 1** to the measured point of the circuit.
3. Press the **Autoset** button.

The oscilloscope will implement the **Autoset** to make the waveform optimized, based on which, you can further regulate the vertical and horizontal divisions till the waveform meets your requirement.

► **Perform Automatic Measurement.**

The oscilloscope can measure most of the displayed signals automatically. To measure the period and frequency of the Channel 1 and the mean and peak-to-peak voltage of the Channel 2, follow below steps:

1. Press the **Measure** button.
2. Select **Add** in the bottom menu.
3. Select **Source** in the right menu; select ① in the left menu.
4. Select **Type** in the right menu; select Period in the left menu.
5. Select **Add** in the right menu, the period options added completes.
6. Select **Freq** in the left menu.
7. Select **Add** in the right menu, the frequency added completes, finish setting of CH1.
8. Select **Source** in the right menu; select ② in the left menu.
9. Select **Type** in the right menu; select **Mean** in the left menu.
10. Select **Add** in the right menu, the **Mean** added completes.
11. Select **PK-PK** in the left menu.
12. Select **Add** in the right menu, the PK-PK added completes, finish setting of CH2.

The measured value will be displayed at the bottom left of the screen automatically (see Figure 44).

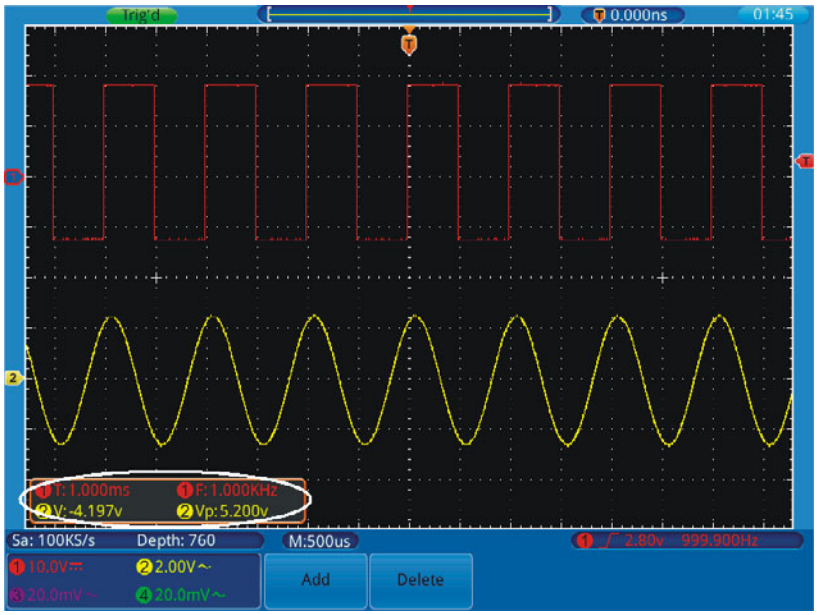


Figure 44. Measure Frequency and PK-PK value for a given signal.

5.2 Example 2: Gain of an Amplifier in a Metering Circuit

The purpose of this example is to work out the Gain of an Amplifier in a Metering Circuit. First we use Oscilloscope to measure the amplitude of input signal and output signal from the circuit, then to work out the Gain by using given formulas.

Set the probe menu attenuation coefficient as **10X** and that of the switch in the probe as **10X** (see "How to Set the Probe Attenuation Coefficient").

Connect the oscilloscope CH1 channel with the circuit signal input end and the CH2 channel to the output end.

► **Operation Steps:**

1. Press the **Autoset** button and the oscilloscope will automatically adjust the waveforms of the two channels into the proper display state.
2. Press the **Measure** button.
3. Select **Add** in the bottom menu.
4. Select **Source** in the right menu; select ① in the left menu.
5. Select **Type** in the right menu; select **PK-PK** in the left menu.
6. Select **Add** in the right menu.
7. Select **Source** in the right menu; select ② in the left menu.
8. Select **Add** in the right menu.
9. Read Vp of Channel 1 and Channel 2 from the measure window at the bottom left of the screen (see Figure 45).
10. Calculate the amplifier gain with the following formulas.

Gain = Output Signal/Input signal.

Gain (db) = 20×log (gain).

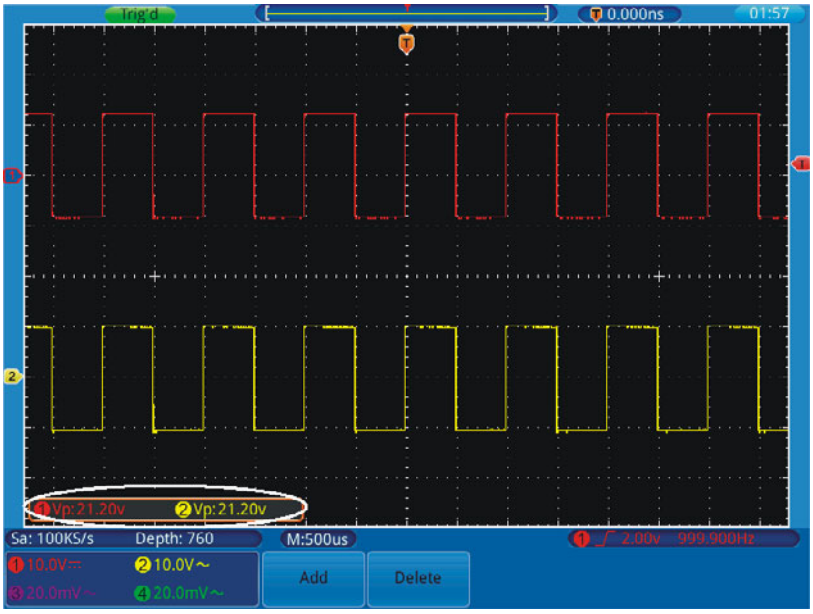


Figure 45. Waveform of Gain Measurement.

5.3 Example 3: Capturing a Single Signal

It's quite easy to use Digital Oscilloscope to capture non-periodic signal, such as a pulse and burr etc. But the common problem is how to set up a trigger if you have no knowledge of the signal? For example, if the pulse is the logic signal of a TTL level, the trigger level should be set to 2 volts and the trigger edge be set as the rising edge trigger. With various functions supported by our Oscilloscope, user can solve this problem by taking an easy approach. First to run your test using auto trigger to find out the closest trigger level and trigger type, this helps user to make few small adjustments to achieve a proper trigger level and mode. Here is how we achieve this.

► **The operation steps are as follows:**

1. Set the probe menu attenuation coefficient to 10X and that of the switch in the probe to 10X (see "How to Set the Probe Attenuation Coefficient").
2. Adjust the **VOLTS/DIV** and **SEC/DIV** knobs to set up a proper vertical and horizontal ranges for the signal to be observed.
3. Press the **TRIGGER Menu** button.
4. Select **Trig Mode** in the bottom menu; select **Edge** in the left menu.
5. Select **Source** in the bottom menu; select ① in the left menu. ②
6. Select **Coupling** in the bottom menu; select **DC** in the right menu.
7. Select **Slope** in the bottom menu; switch it to **Rising**.
8. Select **Mode&HoldOff** in the bottom menu; select **Single** in the right menu.
9. Adjust the trigger level to the roughly 50% of the signal to be measured, you can use the **TRIG LEVEL** knob or the touchscreen (see "Set the Vertical System through touchscreen").
10. Check the Trigger State Indicator on the top of the screen, if it is not Ready, push down the **Run/Stop** button and start acquiring, wait for trigger to happen. If a signal reaches to the set trigger level, one sampling will be made and then displayed in the screen. By using this approach, a random pulse can be captured easily. For instance, if we want to find a burst burr of high amplitude, set the trigger level to a slightly higher value of the average signal level, press the **Run/Stop** button and wait a trigger. Once there is a burr occurring, the instrument will trigger automatically and record the waveform during the period around the trigger time. By turning the **HORIZONTAL POSITION** knob in the horizontal control area in the panel, you can change the horizontal triggering position to obtain the negative delay, making an easy observation of the waveform before the burr occurs (see Figure 46).

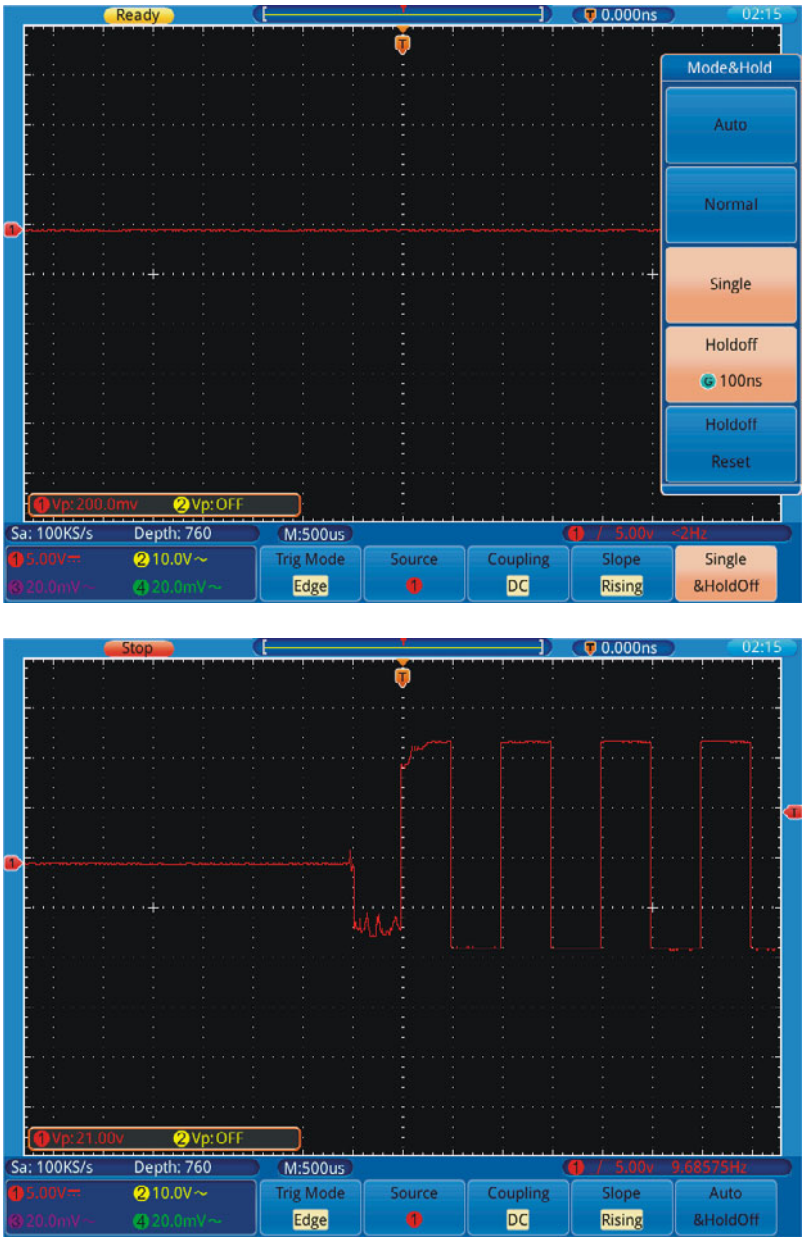


Figure 46. Capturing a Single Signal.

5.4 Example 4: Analyze the Details of a Signal

Noise is very common inside most of the electronic signal. To find out what's inside the noise and reduce the level of noise is very important function our oscilloscope is capable to offer.

► Noise Analysis

The level of noise sometime indicates a failure of electronic circuit. The Peak Detect functions acts an important role to help you to find out the details of these noise. Here is how we do it:

1. Press the **Acquire** button.
2. Select **Mode** in the bottom menu; select **Peak detect** in the right menu.

The signal displayed on the screen containing some noise, by turning on Peak Detect function and changing time base to slow down the incoming signal, any peaks or burr would be detected by the function (See Figure 47).

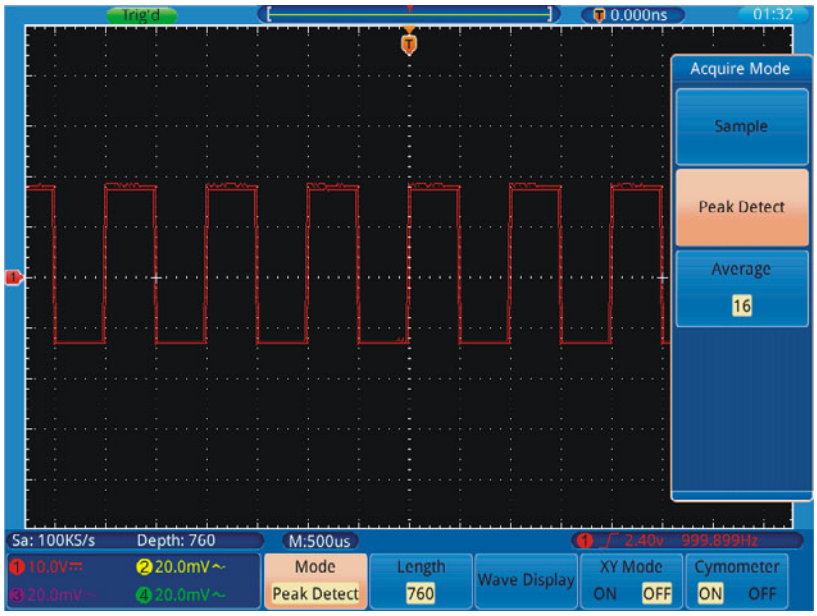


Figure 47. Signal with Noises.

► Separate Noises from the Signal

When focusing on signal itself, the important thing is to reduce the noise level as lower as possible, this would enable user to have more details about the signal. The Average function offered by our Oscilloscope can help you to achieve this.

Here are the steps for how to enable Average function.

1. Press the **Acquire** button.
2. Select **Mode** in the bottom menu; select **Average** in the right menu.
3. Turn the **G** knob and observe the waveform obtained from averaging the waveforms of different average number.

User would see a much reduced random noise level and make it easy to see more details of the signal itself. After applying Average, user can easily identify the burrs on the rising and falling edges of some part of the signal (see Figure 48.).

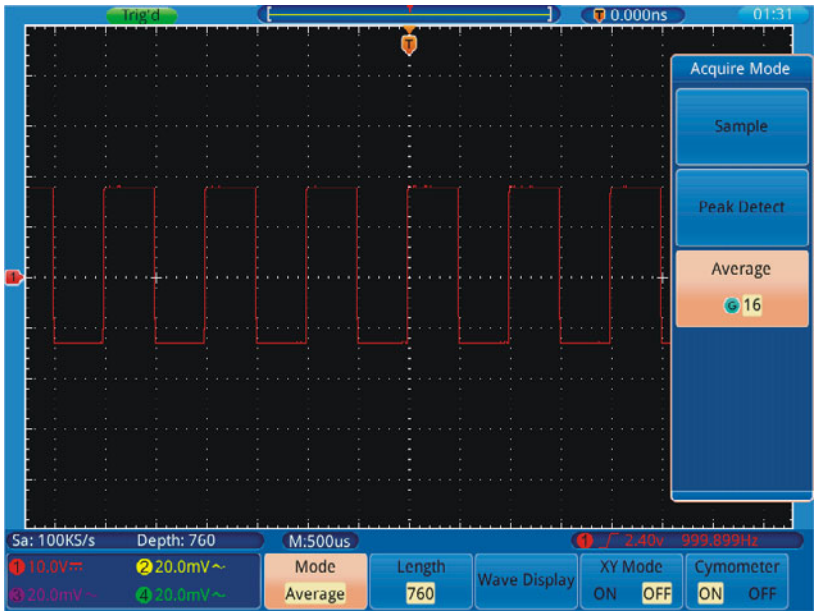


Figure 48. Reduce Noise level by using Average function.

5.5 Example 5: Application of X-Y Function

► **Examine the Phase Difference between Signals of two Channels.**

Example: Test the phase change of the signal after it passes through a circuit network.

X-Y mode is a very useful when examining the Phase shift of two related signals. This example takes you step by step to check out the phase change of the signal after it passes a specified circuit. Input signal to the circuit and output signal from circuit are used as source signals.

For the examination of the input and output of the circuit in the form of X-Y coordinate graph, please operate according to the following steps:

1. Set the probe menu attenuation coefficient for 10X and that of the switch in the probe for 10X (see "How to Set the Probe Attenuation Coefficient").
2. Connect the probe of channel 1 to the input of the network and that of Channel 2 to the output of the network.
3. Turn on CH1 and CH2, turn off CH3 and CH4 using the **CH1~CH4** keys.
4. Push down the **Autoset** button, with the oscilloscope turning on the signals of the two channels and displaying them in the screen.
5. Turn the **VOLTS/DIV** knob, making the amplitudes of two signals equal in the rough.
6. Press the Acquire button to display menu in the bottom.
7. Switch **XY Mode** as **ON**.

   The oscilloscope will display the input and terminal characteristics of the network in the Lissajous graph form.
8. Turn the **VOLTS/DIV** and **VERTICAL POSITION** knobs, optimizing the waveform.
9. With the elliptical oscillogram method adopted, observe and calculate the phase difference (see Figure 49).

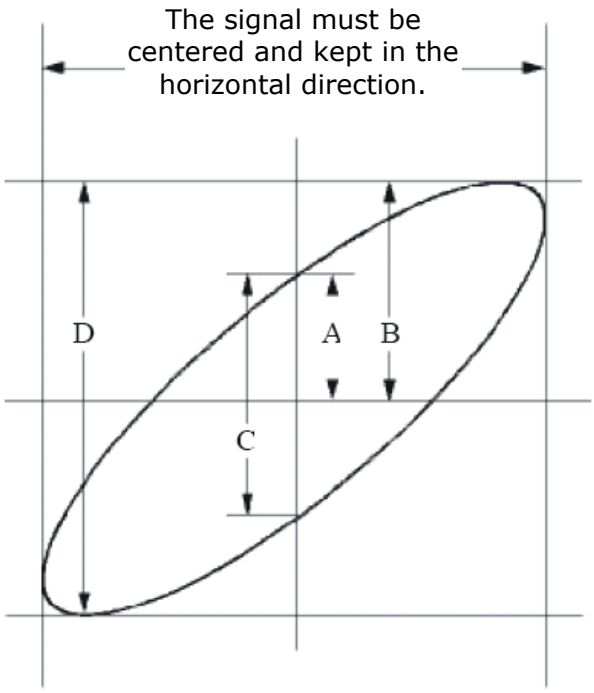


Figure 49. Lissajous Graph.

Based on the expression **sin (q) =A/B or C/D**, there into, **q** is the phase difference angle, and the definitions of A, B, C, and D are shown as the graph above. As a result, the phase difference angle can be obtained, namely, **q = ± arcsin (A/B)** or **± arcsin (C/D)**. If the principal axis of the ellipse is in the I and III quadrants, the determined phase difference angel should be in the I and IV quadrants, that is, in the range of (0 ~π /2) or (3π / 2 ~2π). If the principal axis of the ellipse is in the II and IV quadrants, the determined phase difference angle is in the II and III quadrants, that is, within the range of (π / 2 ~π) or (π ~3π /2).

5.6 Example 6: Video Signal Trigger

Observe the video circuit of a television, apply the video trigger and obtain the stable video output signal display.

► **Video Field Trigger**

For the trigger in the video field, carry out operations according to the following steps:

1. Press the **TRIGGER Menu** button.
2. Select **Trig Mode** in the bottom menu; select **Video** in the left menu.
3. Select **Source** in the bottom menu; select ① in the left menu.
4. Select **Modu** in the bottom menu; select **NTSC** in the right menu.
5. Select **Sync** in the bottom menu; select **Field** in the right menu.
6. Turn the **VOLTS/DIV**, **VERTICAL POSITION** and **SEC/DIV** knobs to obtain a proper waveform display (see Figure 50).

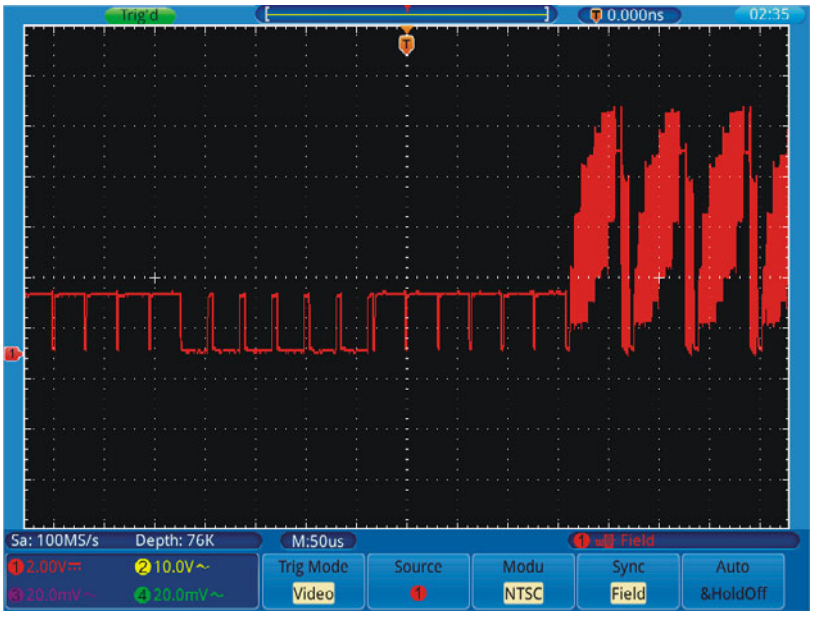


Figure 50. Waveform Captured from Video Field Trigger.

6 TROUBLESHOOTING

- **Oscilloscope is powered on but no Display.**
  - Check whether the power connection is connected properly.
  - Restart the instrument after completing the checks above.
  - If the problem persists, please contact PROMAX and we will be under your service.
- **After acquiring the signal, the waveform of the signal is not displayed in the screen.**
  - Check whether the probe is properly connected to the signal connecting wire.
  - Check whether the signal connecting wire is correctly connected to the BNC (namely, the channel connector).
  - Check whether the probe is properly connected with the object to be measured.
  - Check whether there is any signal generated from the object to be measured (the trouble can be shot by the connection of the channel from which there is a signal generated with the channel in fault).
  - Make the signal acquisition operation again.
- **The measured voltage amplitude value is 10 times or 1/10 of the actual value.**

  Look at the attenuation coefficient for the input channel and the attenuation ration of the probe, to make sure they are match (see "How to Set the Probe Attenuation Coefficient").
- **There is a waveform displayed, but it is not stable.**
  - Check whether the **Source** item in the **TRIG MODE** menu is in conformity with the signal channel used in the practical application.
  - Check on the trigger **Type** item: The common signal chooses the Edge trigger mode for **Type** and the video signal the **Video**. Only if a proper trigger mode is applied, the waveform can be displayed steadily.
  - Try to change the trigger coupling into the high frequency suppress and the low frequency suppress to smooth the high frequency or low frequency noise triggered by the interference.

- **No Display Responses to the Push-down of Run/Stop.**

  Check whether Normal or Signal is chosen for Polarity in the TRIG MODE menu and the trigger level exceeds the waveform range.

  If it is, make the trigger level is centered in the screen or set the trigger mode as Auto. In addition, with the **Autoset** button pressed, the setting above can be completed automatically.

- **The displaying of waveform seems getting slow after increasing AVERAGE value in Acqu Mode** (see "How to Implement Sampling Setup")**, or a longer duration is set in the Persist in Display** (see "Persist")**.**

  It's normal as the Oscilloscope is working hard on many more data points.

7 SPECIFICATIONS

BANDWIDTH	200 MHz.	
Channel	4.	
ACQUISITION		
Mode	Normal, Peak detect, Averaging.	
Waveform Capture rate	50,000	
Max. Sample rate (real time)	Four CH Dual CH Single CH	1 GS/s. 2 GS/s.* 2 GS/s.
INPUT		
Input coupling	DC, AC, Ground.	
Input impedance	1 MΩ ± 2%, in parallel with 10 pF ± 5 pF, 50Ω ± 1%.	
Probe attenuation factor	1X, 10X, 100X, 1000X.	
Max. input voltage		
1 MΩ input impedance	400 V (PK-PK) (DC + AC PK-PK).	
50 Ω input impedance	5 V (PK-PK) (DC + AC PK-PK).	
Bandwidth limit	20 MHz, full bandwidth.	
Channel – channel isolation	50 Hz: 100:1 10 MHz: 40:1	
Time delay between channel (typical)	150 ps.	
HORIZONTAL SYSTEM		
Sampling rate range	Four CH Dual CH Single CH	0.5 S/s ~ 1 GS/s 0.5 S/s ~ 2 GS/s 0.5 S/s ~ 2 GS/s
Interpolation	(sin x)/x	
Max. Record length	≤ Max sampling rate, 7.6M	
Scanning speed (S/div)	2 ns/div ~ 100 s/div, step by 1 ~ 2 ~ 5.	
Sampling rate / relay time accuracy	± 100 ppm.	
Interval (ΔT) accuracy (DC~100MHz)		
Single	± (1 interval time + 100 ppm x reading + 0.6 ns).	
Average >16	± (1 interval time + 100 ppm x reading + 0.4 ns).	

* Max Sample rate (real time) for Dual CH: Select one of the channels in CH1 and CH2 and the other one in CH3 and CH4.

VERTICAL SYSTEM

A/D converter	8 bits resolution (4 Channel simultaneously)
Sensitivity	2 mV/div ~ 10 V/div.
Displacement	± 10 div
Analog bandwidth	200 MHz.
Low Frequency	≥ 5 Hz (at input, AC coupling, -3dB).
Rise time	≤ 1.7 ns (at input, Typical).
DC accuracy	± 3%.
DC accuracy (average)	Average > 16: ± (3 % rdg + 0.05 div) for ΔV.
Waveform inverted	ON/OFF.

MEASUREMENT

Cursor	Δ V and Δ T between cursors.
Automatic	PK-PK, Max, Min, Vtop, Vbase, Vamp, Mean, RMS, Overshoot, Preshoot, Freq, Period, Rise Time, Fall Time, Delay A→B , Delay A→B , +Width, -Width, +Duty, -Duty.
Waveform Math	+, -, *, / ,FFT.
Waveform storage	4 reference waveforms (support for move, zoom in, zoom out and expanded display).
Lissajous figure	
Bandwidth	Full bandwidth.
Phase difference	± 3 degrees.

COMMUNICATION PORT	USB 2.0, USB for file storage; LAN port; VGA interface.

TRIGGER

Trigger level range	
Internal	±6 div from the screen center.
Trigger level Accuracy (typical)	
Internal	±0.3 div.
Trigger displacement	According to Record length and time base.
Trigger Holdoff range	100ns ~ 10s.

50% level setting(typical)	Input signal frequency ≥50Hz.
Edge trigger	
Slope	Rising, Falling
Sensitivity	0.3 div.
Pulse trigger	
Trigger condition	Positive pulse: >, <, = Negative pulse: >, <, =
Pulse Width range	30 ns ~ 10 s.
Video Trigger	
Modulation	Support standard NTSC, PAL and SECAM broadcast systems.
Line number range	1-525 (NTSC) and 1-625 (PAL/SECAM).
Slope Trigger	
Trigger condition	Positive pulse > <, =; Negative pulse > <, =.
Time setting	24 ns ~ 10 s.

DISPLAY

Display Type	8" touchscreen color LCD.
Display Resolution	800 (Horizontal) × 600 (Vertical) Pixels.
Display Colors	65536 colors, TFT screen.

OUTPUT OF THE PROBE COMPENSATOR

Output Voltage (Typical)	About 5 V, with the Peak-to-Peak voltage ≥ 1MΩ.
Frequency (Typical)	Square wave of 1 KHz.

POWER

Mains Voltage	100 ~ 240 VAC RMS, 50/60Hz, CAT II.
Power Consumption	< 24 W.

OPERATING ENVIRONMENTAL CONDITIONS

Temperature	Working temperature: 0 °C ~ 40 °C. Storage temperature: -20 °C ~ 60 °C.
Height	Operating: 3.000 m. Non-operating: 15.000 m.
Max. relative humidity	≤90 %.
Cooling Method	Natural convection.

MECHANICAL FEATURES

Dimensions	L. 380 mm x H. 180 mm x W. 115 mm.
Weight	About 1.9 kg.

INCLUDED ACCESSORIES

4 x Passive probe: 1.2 m, 1:1 (10:1).
1 x Power cord.
1 x USB cable.
0 DG0153 Quick Guide.

RECOMMENDATIONS ABOUT THE PACKING

It is recommended to keep all the packing material in order to return the equipment, if necessary, to the Technical Service.

INTERVAL PERIOD OF ADJUSTMENT

One year is recommended for the calibration interval period.

NOTE: The technical specifications applied are for Probes attenuation set as 10X. Only if the oscilloscope fulfills the following two conditions at first, these specification standards can be reached.

- ► This instrument should run for at least 30 minutes continuously under the specified operating temperature.
- ► If change of the operating temperature is up to or exceeds 5 °C, do a "Self-calibration" procedure (see "How to Implement Self-calibration").

All specification standards can be fulfilled, except one(s) marked with the word "Typical".

8 MAINTENANCE

8.1 General Care

Do not store or leave the instrument where the liquid crystal display will be exposed to direct sunlight for long periods of time.

CAUTION: To avoid any damage to the instrument or probe, do not exposed it to any sprays, liquids, or solvents.

8.2 Cleaning

Inspect the instrument and probes as often as operating conditions require.

To clean the instrument exterior, perform the following steps:

1. Wipe the dust from the instrument and probe surface with a soft cloth. Do not make any scuffing on the transparent LCD protection screen when clean the LCD screen.
2. Disconnect power before cleaning your Oscilloscope. Clean the instrument with a wet soft cloth not dripping water. It is recommended to scrub with soft detergent or fresh water. To avoid damage to the instrument or probe, do not use any corrosive chemical cleaning agent.

WARNING: Before power on again for operation, it is required to confirm that the instrument has already been dried completely, avoiding any electrical short circuit or bodily injury resulting form the moisture.

PROMAX ELECTRONICA, S. L.

Francesc Moragas, 71-75
08907 L'HOSPITALET DE LLOBREGAT (Barcelona)
SPAIN
Tel. : 93 184 77 00 * Tel. Intl. : (+34) 93 184 77 02
Fax : 93 338 11 26 * Fax Intl. : (+34) 93 338 11 26
http://www.promaxelectronics.com
e-mail: promax@promaxelectronics.com